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No. 296

ENERGY: STATUS AND DEVELOPMENT --XII

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21 December 1982

CHINA REPORT ECONOMIC AFFAIRS

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NATIONAL POLICY

WORK ON DRAFTING 'CHINA'S ENERGY POLICY OUTLINE RECOMMENDATIONS' COMPLETED

Beijing GUANGMING RIBAO in Chinese 8 Nov 82 p 1

[Report by Song Guangming]

[Text] Thanks to the concern of the Party Central Committee and the State Council, the work of drafting "China's Energy Policy Outline Recommendations" has now been completed. It is China's first such energy policy outline.

The energy "Outline," based on the actual conditions in China, discusses the strategic thinking in drafting an energy policy and calculates the amount of energy supply necessary for the nation to meet its strategic goals of economic growth by the year 2000. The "Outline" puts forth concrete recommendations for technical and economic policies covering energy development, transportation, and comprehensive use, based on a total of 16 considerations: the energy situation in China, energy supply and demand forecasts, energy development strategies, coal, petroleum and natural gas, hydropower, nuclear power, electric power [supply], new energy resources, energy conservation, rural energy, urban civilian energy, energy transmission and shipping, the environmental aspects of energy production and utilization, economic policies on energy and S&T research and education regarding energy. Concerned organs have already begun to put into effect some of these recommendations.

The work of drafting this outline began in 1979, after the 3d Plenum of the 11th Central Committee. Under the joint direction of the State Science and Technology Commission, the State Planning Commission and the former State Energy Commission, the Energy Research Association invited some 500 specialists, professors and management personnel from 170 units representing concerned departments, S&T organs, and institutions of higher learning to participate in the drafting work. After extensive investigations, opinion polls, comprehensive academic studies and deliberation at three conferences of energy specialists covering a period of more than 3 years, it has now been finalized. The entire document runs to [about 250,000 words.] more than 500,000 characters. Throughout the outline draft compilation process, the Energy Research Association handled the bulk of the work of organizing and editing.

CSO: 4013/57

NATIONAL POLICY

ARTICLE ATTEMPTS TO PUT DEVELOPMENT OF HYDROPOWER, THERMAL POWER INTO PROPER PERSPECTIVE

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82, pp 9-11,17

[Article by Zhang Siping [1728 1835 1627]: "Several Views on the Development of Utilization of Our Nation's Hydraulic Resources--and a Discussion With Comrades Shen Xinxiang [3088 0207 4382] and Guo Zhongxing [6753 0022 5281]"]

[Text] I was inspired by an article entitled "The Position of Hydroelectricity in Our Nation's Energy" written by comrades Shen Xinxiang [3088 0207 4382] and Guo Zhongxing [6753 0022 5281] in the No. 2, 1981 issue of the "Journal of Energy". But I also felt that some viewpoints and methods in the article are worth further discussion. At the same time, as these viewpoints are popular in the present study of our nation's energy economics and energy policy, I will present some views on several questions concerning the development and utilization of hydroelectricity and discuss them with comrades Shen and Guo.

I. We Must Evaluate Our Nation's Energy Resources on an Overall Basis

Hydroenergy is a clean and renewable energy. China's hydraulic resources are rich. This is the superiority of our nation's energy resources, therefore, the policy to develop hydroelectricity as a priority is correct. But what is the position of hydroelectricity in our nation's energy? We cannot just evaluate the hydraulic resources themselves. We should evaluate all types of energy resources on an overall basis before we can make a correct conclusion. In describing the position of hydroelectricity in China's energy, comrade Shen has neglected to give an overall evaluation of the positions of our nation's coal, petroleum, nuclear energy, and natural gas. At the same time, in order to explain the importance of hydroelectricity, he has also down-graded the position of coal. I believe this method is unacceptable.

Comrades Shen and Guo estimated the number of years of exploitation of our nation's coal in their article and they concluded: "The number of years of exploitation of the current known reserves in our nation is less than a hundred years." I believe this is not factual: our nation's known reserves of coal total 640 billion tons. Between 1949 and 1979, a span of 30 years, only 8.6 billion tons were extracted. Even if we calculate

at the current 50 percent stoping rate, the known exploitable reserves of coal amount to 320 billion tons. China now produces 600 million tons of coal a year and we plan to reach 1.2 billion tons by the end of this century. At an annual production level of 1.2 billion tons, the exploitable number of years for coal is over 260 years. As prospecting work develops, each year, new reserves are provided. This far surpasses the reserves used up during the current year. Therefore, the development of our nation's coal industry has great potential. Underestimating the position and the function of coal is improper.

In recent years, comrades from all sectors of our nation have shared a tendency in discussing energy problems, i.e., in order to prove the importance of a certain type of energy, each sector improperly underestimates the function of other forms of energy. This phenomenon is unfavorable to correctly evaluate, rationally develop and effectively utilize China's energy resources.

II. We Must Fully Recognize the Dual Nature of Developing and Utilizing Hydroelectricity

The development and utilization of every kind of energy have their advantages and limitations, i.e., an advantageous aspect and an unfavorable aspect. We should see the duality in understanding, evaluating, developing and utilizing various kinds of energy, and we should develop their superiority and their favorable aspects as much as possible and avoid or reduce their limitations and their unfavorable aspects. When the article by Shen and Guo evaluated hydroelectricity, it only saw the superiority of hydroelectricity and it cited five major advantages but it did not discuss the limitations of hydroelectricity. This is not an overall evaluation. Of course, hydroelectricity possesses many superiorities, but compared to thermoelectricity, it also has definite limitations, for example:

1. Greater Investment. The article by Shen and Guo concluded from a comparison of hydroelectricity and thermoelectricity: "When hydroelectricity does not include comprehensive utilization, the investment in hydroelectricity and the investment in thermoelectricity are about the same." This is not accurate enough. According to statistics, from 1950 to 1980, the average investment per kilowatt of installed capacity of hydroelectric power was 660 yuan, but adding the corresponding investment of 261 yuan in the coal mines, the total comes to 921 yuan (the investment in power transmission lines for hydroelectricity is almost the same as the investment in railways to transport coal for thermal power plants). The investment in hydroelectricity is 27 percent higher than thermoelectricity. If we calculate by investment in electrical energy, the investment in hydroelectric power will be even higher. China has insufficient funds for investment, and the higher investment in hydroelectricity is surely one factor limiting the development of hydroelectric power.

2. The Construction Period Is Longer. The article by Shen and Guo held that "the construction period for hydroelectric power is no longer than the construction period for coal-fired electricity." This is not factual. Generally speaking, the construction period of large and medium hydroelectric power stations is 5 to 10 years. The construction period of large and medium thermal power plants is 3 to 5 years, and the construction period of large and medium coal mines is 5 to 10 years. Although the sum of the construction periods for thermoelectric power and coal mines is longer than that for hydroelectric power, if we rationally arrange the construction of coal mines and thermoelectric power, for example, designing both at the same time and constructing both at the same time, then the construction period is shorter than that for hydroelectric power by about 3 years (although large coal mines require about 10 years for completion, generally they can produce coal after 5 years for use by power plants). At present, China has an energy shortage. The long construction period for hydroelectric power is also a limiting factor in the development of hydroelectricity.

3. The Variation in the Output of Hydroelectricity Between the Period of Abundant Water and the Dry Period Is Large. The article by Shen and Guo compared the performance of hydroelectric power and thermal power and concluded: "Hydroelectricity is more versatile in use than thermoelectricity." But hydroelectricity also has the shortcomings of poor regularity and instability. Hydroelectricity is greatly influenced by natural conditions. Generally the guaranteed output constitutes about one-third the installed capacity. This creates a whole series of problems for industrial and agricultural production and in people's life and this is also an outstanding unfavorable aspect of hydroelectricity.

In addition, the article only talked about the "effects of comprehensive utilization" of hydroelectricity and its "improvement of the natural environment", but there is also the possibility that the construction of hydroelectric power stations will destroy the natural ecological balance and unfavorably affect the environment. Mentioning only that thermoelectricity will pollute the environment but not mentioning that hydroelectricity also has its unfavorable aspects is not an overall argument.

Since the founding of the nation, we have undergone a long-lasting "battle between hydroelectricity and thermoelectricity." In the past, some comrades placed too much emphasis on the unfavorable aspects of hydroelectricity, and along with political and economic reasons, they exerted an unwarranted influence upon the development of our hydroelectricity. This of course is a lesson that should be conscientiously learned. But conversely, neglecting the limitations of hydroelectricity and the unfavorable aspects was also inappropriate. I believe it would be more favorable to the full and rational development and utilization of our hydraulic resources if we fully recognize the advantages and the limitations in the development of hydroelectricity and conscientiously solve the limitations.

III. Only by Combining Hydroelectric Power and Thermal Power Can the Superiority of Hydraulic Resources Be Developed

The article by Shen and Guo mentioned that "we should develop hydroelectric power in a big way." This is of course right. But to develop hydroelectric power in a big way and to fully develop the superiority of hydraulic resources, we must base our efforts on the operating requirements of the power system and pay attention to developing thermal power so that hydroelectric power and thermal power can be combined and so that they can mutually supplement each other and be coordinated.

As the modernization of the national economy develops, the amount of electric power demanded by industrial and agricultural production will increase, and quality demands will be higher. Therefore, objectively, the power system must be stable, safe, versatile and economical. To realize this, having only hydroelectric power will not work. This is because China has a monsoon climate with clearly defined dry and wet seasons. At elevations high above sea level, there are basically no natural lakes to regulate the climate, therefore the amount of flow in rivers is extremely seasonal, the guaranteed output of hydroelectric power stations is low, the regulatory function is poor, the difference between peaks and troughs is large, providing only a seasonal supply of electricity. This situation is unsuitable to the need for stable operation of the electric power system. For this, there must be a definite number of thermal power plants that can coordinate the output. As long as thermal power stations have a guaranteed supply of coal, their number of hours of utilization is very high and they can generate electricity in a stable manner. On the other hand, thermal power generators start up slowly, and they are not suitable for the task of peak regulation, frequency regulation, or serving as a reserve during accidents. The power system also requires a fixed number of hydroelectric power stations that are versatile and convenient to regulate peaks and frequency and to serve as a reserve during accidents. Only in this way can the entire power system be safe, versatile, economical and operate in the best state. The most suitable ratio between hydroelectric power and thermal power can only be determined by the actual situation of each power system.

It can be seen that hydroelectric power and thermal power both have their own advantages and limitations. Only by utilizing the advantages to make up for the shortcomings and by coordinating the two can we realize better economic gains and fully develop the superiority of hydroelectric power. In recent years, in some of our regions where the proportion of hydroelectricity is large, the ability of the hydroelectric power facilities has been fully developed during the period of abundant water so that they can carry the basic load. Thermal power has been used to regulate the peaks, to conserve fuel and reduce the cost of production of electricity in the system. During the dry season, thermal power carries the basic load and hydroelectric power is used to regulate the peaks. This arrangement not only develops the superiority of hydroelectric power to adapt to changes in a versatile manner, it also satisfies the needs for electricity in production and realizes good economic results for the entire power system.

IV. The Scale and Rate of Developing Hydroelectric Power Should Suit the Actual Need for Production and Consumption of Electricity

The article by Shen and Guo mentioned several problems that need to be solved in developing hydraulic resources. These, of course, are very important and they need to be solved conscientiously. But, in the rational development of hydraulic resources, we must first solve the problem of determining the scale and the rate of building up hydroelectric power according to the actual need for electricity by every sector of the national economy.

Today, most of China's electric power is not used as the final product for consumption by the people. It is an intermediate product to provide conditions for other sectors to create the final products. According to the requirements of the basic economic laws of socialism, our development of hydraulic resources is not for the sake of development alone but to provide more benefits to the various sectors of the national economy and to benefit people's lives to the maximum extent possible. Therefore, the rate of development of hydroelectric power and its scale are not only limited by the natural conditions of hydraulic resources and the level of state investment, it is also limited by the structure of electricity consumption in the various sectors of the national economy and the actual need. Because it is not possible for our nation to establish a large, unified national power network in the near future, the development of hydroelectric power must be limited by the structure of electricity consumption and the need within the regional power systems. China's hydraulic resources are distributed very unevenly. The production of electricity by each power system, the consumption structure and the actual needs vary greatly. During the course of developing hydroelectric power, we must carry out concrete analysis under the prerequisite of conducting technical and economic comparisons studying the order, time, rate, and scale of development of hydroelectric power in each region. Speaking in general about developing hydroelectric power in a big way does not have any practical meaning.

For example, the power shortage is more outstanding in Hunan, Hubei and Guangxi. Hydraulic resources are more abundant, and there is less coal. On the surface, it seems that we only have to develop hydroelectric power in a big way to solve these regional problems of electric power. But after concrete analysis, the situation is not that simple. These regional power systems have three characteristics: One is that the proportion of hydroelectricity is large, all surpassing 50 percent. The second is that most of the currently existing hydroelectric power stations are runoff power stations, their regulatory function is poor, and the difference between peaks and troughs is very large. For example, the output of electricity generated during the period of abundant water in Hunan can reach 1.59 million kilowatts, but during the dry season it is only 870,000 kilowatts. The output of hydroelectricity of the main power network in Guangxi during the period of abundant water reaches 400,000 kilowatts but it is only 100,000 kilowatts during the dry season. The third is that the dry season is long. Generally speaking, the dry

season lasts 5 to 6 months a year. And with a deficiency in the installed capacity of thermal power which cannot supplement the shortage during the dry season, many enterprises have for many years actually been forced into seasonal production. In view of the balance between electric power supply and demand, the electric power output during the season of abundant water in these regions can basically guarantee the need (In some regions such as Hunan, water is sometimes lost during period of abundant water). The shortage of electricity occurs mainly during the dry season. For example, because of the shortage of electricity during the dry season in Guangxi, the value of industrial production is reduced by 600 to 700 million yuan each year. In Hunan in 1978, production value was reduced 4 billion yuan because some factories were forced to produce seasonally.

To solve the problem of electric power in these regions, we must of course develop hydroelectric power bases with good economic conditions, such as the Wuqiangxi in Hunan, the Hongshui He in Guangxi, and the Qing Jiang in Hubei. But at the same time, we must correspondingly develop thermal power so that hydroelectric power and thermal power can be coordinated to solve the problem of the shortage of electricity in these regions together. If we rely only on developing hydroelectric power, then when the seasonal load is not greatly increased, we will only deepen the seasonal nature of electric power production in these regions, and this will affect the stability of the power system and the economic results of the various sectors of the national economy. At the same time, it is not worth it economically, because if we use the development of hydroelectric power as a measure to solve the problem of shortage of electric power during the dry season, we must require that the guaranteed output of hydroelectric power be sufficient to make up for the installed capacity that is deficient during the dry season. To meet this requirement, we need to increase the installed capacity by several times that of the thermal power stations we construct, and this will make a large amount of installed capacity become a year-round "in-between capacity". This ties up capital and creates a huge waste.

In summary, I believe the development of our nation's electric power industry in the future must be based on the concrete situation and the actual need in each locality. We must suit measures to local circumstances, develop hydroelectric power and thermal power together, and, while planning and building some large hydroelectric power bases, we must correspondingly develop thermal power, use the appropriate development of thermal power to provide necessary conditions for developing the superiority of hydraulic resources, promote the development of the superiority of hydraulic resources to find a numerical balance between electric power supply and demand in each region, to connect the two in time, and to promote the rapid development of all sectors of the national economy.

V. We Must Estimate the Role and the Function of Hydroelectric Power in China's Energy During This Century by Seeking Truth From Facts

Developing hydraulic resources as a priority and gradually improving the proportion of hydroelectricity constitute one of the long-term strategic policies to build up China's energy. But we cannot overestimate the role

of hydroelectricity within this century. We cannot place too much hope on the development of hydroelectricity to develop China's power industry and thus relax our efforts to build up thermal power and develop coal. I believe hydroelectricity cannot become our major energy source within this century. This is not only limited by state investment, it is also limited by the geographic distribution and the characteristics in the development and utilization of hydraulic resources.

First, hydraulic resources are limited by geographic distribution. Although China's hydraulic resources are very rich, the distribution is very unbalanced. Over 80 percent are distributed in the remote southwest and the northwest regions where the economy is not developed. The percentage of hydraulic resources in the northeast, northern China and eastern China, where the economy is developed and where the load of consumption of electricity is concentrated, is 1.9 percent, 1.1 percent and 2.6 percent respectively. The regions with the greatest shortage of electricity in China are the regions where there are less hydraulic resources. If we develop hydroelectricity in the southwest and the northwest in a big way to satisfy the need for electric power in these regions, electricity will have to be transmitted over long distances. This increases state investment and there are still many technical problems that need to be solved. Doing so within this century while our capital is limited is unsuitable. Therefore, within this century, the buildup of our electric power must involve the development of large hydroelectric power bases that are near the load centers and that have better conditions for development, and we must pay attention to the development of thermal power (including nuclear power) in such regions as the northeast, northern China and eastern China to satisfy the need for electric power to develop the economy in these regions.

Second, hydraulic resources are limited by the construction period of hydroelectric power. There must be a process in developing hydraulic resources. The construction of large and medium hydroelectric power stations requires over 10 years from surveying, designing, and construction to completion. Even if we hasten the development of hydroelectric power starting from now, it would still be difficult for hydroelectric power to become our nation's major source of energy. In addition, only a small portion of the 370 million kilowatts of exploitable hydraulic resources has been geologically prospected to a greater extent, and engineering designs up to the stage of selecting dam sites have been drawn up for only a small portion of such resources. About 80 percent of them still require further and massive geological prospecting, planning and designing. This also requires a definite time.

Also, hydraulic resources are limited by the characteristics of utilization. The large-scale utilization of hydraulic resources at the present stage still involves only the generation of electricity. They are not like mineral energy sources (coal, petroleum) which can be used as power as well as fuel or raw materials, and they are not like coal and petroleum, which can be stored in large quantities and which can also be transported

over long distances. In addition, of the amount of coal consumed in our nation at present, less than 20 percent is used to generate electricity. Even if within this century hydroelectric power completely replaces thermal power, it is still not possible for hydroelectric power to become the main source of power in the energy consumption structure. Therefore, within this century, China's consumption of energy will still be mainly the consumption of mineral energy sources, i.e., mainly coal.

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NATIONAL POLICY

AMBITIOUS ENERGY GOALS CAN BE MET ONLY WITH MASSIVE MODERNIZATION, CONSERVATION

OW061436 Beijing XINHUA Domestic Service in Chinese 1427 GMT 4 Nov 82

[Excerpts] Beijing, 4 Nov (XINHUA)--According to XINHUA reporter Zhou Changnian, in Beijing recently experts of various branches of learning maintained that the seemingly difficult task of attaining the goal put forward by Premier Zhao Ziyang of quadrupling the energy supply by the end of this century is not impossible provided that modern scientific and technological knowhow is applied in energy development and conservation, and that energy resources are managed and utilized in such a manner that the situation of the whole country is taken into consideration.

This view was reflected by some 30 scientists and administrators while attending a symposium sponsored by the China Association for Science and Technology from 1 through 2 November to discuss matters concerning energy. These experts, whose work is related to energy, represent 13 national societies under the association, including geology, coal, petroleum, water conservancy, nuclear research, energy research, railways, chemical engineering, and others.

They pointed out at the meeting that to boost our country's energy supply the development of new bases of coal and oil production must be intensified, the old bases' economic efficiency must be enhanced, and hydroelectric and nuclear power must be developed. To this end, they said, major scientific and technological issues in energy development must be resolved through tackling the major problems, and new achievements and new technologies must be energetically popularized and applied.

These experts unanimously stressed that, in energy development, conservation of energy is just as important as broadening the energy resources.

They said that China's iron and steel industry, while increasing its output, will register a drop of energy consumption equal to 8 million tons of standard coal from 1978 through 1982.

They said that experience during the past three decades and more shows that China's major energy problems lie not so much in inadequate development of new energy resources as in ineffective conservation. They reported that a large number of

factories and enterprises in the country do not even have a basic understanding of energy conservation and that certain energy conservation measures which have been proven effective have not been popularized and applied. They said this abnormality must be quickly corrected.

These experts maintained that in the light of China's technical strength and foundation many major problems in energy development and conservation can be fully resolved, and that much work can be accomplished in energy development. But due to departmentalism in many departments, trades, units and areas, many problems have become entangled and deadlocked and have remained unresolved for a long time. They pointed out that to achieve a more efficient use of our country's energy the nation's needs must be taken into consideration, and ideas of decentralism and departmentalism must be eliminated; all departments, trades, units and areas must be educated to understand that energy is a problem that must be tackled with collective efforts; and leading departments concerned must be urged to properly coordinate the operations of various quarters.

These experts pointed out that the many drawbacks in China's energy administration and utilization have given rise to a tremendous waste of energy as well as manpower and financial resources and have dampened the energy department's enthusiasm. For example, since our economic policy forbids fixing coal prices according to its grades, coal has been marketed with rock for a long time, and our trains have to transport tens of millions of tons of rock every year; and the consuming units have to use dynamite to separate the coal from the rock. Another problem lies in the fact that coal is not used efficiently, thus giving rise to the relatively serious phenomenon that good coal is burned for purposes for which inferior coal would have been adequate. Still another problem in energy conservation has been the phenomenon of "whipping the efficient cattle." This means that those enterprises which have effectively conserved energy are penalized by having their energy supply reduced substantially, and that they are not properly commended for having lowered the production cost and making greater profits as a result of their energy conservation and for the hard work that is involved in certain difficult conservation projects; while the energy supply for those enterprises which are not as effective in conservation and which simply have refused to conserve is not as substantially reduced or not reduced at all. To rectify these abnormalities these experts proposed that the state must formulate the necessary policies and measures for encouraging the development of energy production and energy conservation and for encouraging scientific administration and utilization of energy. They also put forward certain specific measures, such as: coal must be meticulously dressed and processed, different types of coal must be priced differently, supply of various types of coal must be ensured at designated areas; cooperation between the coal and chemical industries and between the coal and electricity departments should be encouraged; production, transportation and marketing of coal must be handled by system engineering methods.

CSO: 4013/55

NATIONAL POLICY

THERMOPHYSICIST OPTIMISTIC ABOUT ECONOMY, SAYS ENERGY PRODUCTION COULD BE DOUBLED BY YEAR 2000

OW081305 Beijing XINHUA in English 1234 GMT 8 Nov 82

[Text] Beijing, 8 Nov (XINHUA)--"China aims to quadruple the value of industrial and agricultural output by the year 2000 while only doubling its energy production," Professor Wu Zhonghua, executive chairman of the Presidium of the Chinese Academy of Sciences today told the China-U.S. conference on energy, resources and environment.

China is fairly rich in energy resources, the professor said, with established coal deposits reaching 600 billion tons, ranking third in the world. Its hydroelectrical resources are extremely rich with theoretical reserves estimated at 680 million kilowatts, the highest of all countries, said Professor Wu Zhonghua, who is concurrently chairman of the Energy Research Committee and president of The Chinese Society of Engineering Thermophysics.

He added that Chinese geologists had discovered three hundred or more sedimentary basins covering a total area up to 4.5 million square kilometers which are worth prospecting. China has offshore continental shelf areas amounting to 1.2 million or more square kilometers, he noted, forming a solid material basis for the development of China's oil and natural gas industry. "China's oil reserves stand at least at 30 billion tons," he said.

"So, China has a broad vista for the expansion of energy production. We estimate that doubling energy production by the year 2000 is quite possible," he said.

He said that the rate of energy utilization in China now is quite low, which implies that a great amount of energy can be tapped through various measures of energy conservation.

The value of industrial and agricultural output in 1981 in China was 749 billion yuan with the consumption of approximately six hundred million tons of standard coal equivalent.

He predicted that energy utilization will be greatly enhanced if the following conditions are met:

The waste of coal, oil, gas, steam, electricity and hot water is substantially reduced in industry; full use is made of waste heat, gas and hot water; technological processes in many of the present enterprises are improved; and old equipment requiring high energy consumption is replaced by new equipment.

Thus, he added, the goal of quadrupling the value of industrial and agricultural output by the year 2000--2,800 billion yuan can be attained by doubling the energy production--1.2 billion tons of standard coal equivalent.

CSO: 4010/20

NATIONAL POLICY

MINISTRY PLANS NATIONWIDE ACCELERATION OF HYDRO, THERMAL POWER PROJECTS

Beijing RENMIN RIBAO in Chinese 12 Oct 82 p 1

[Text] The Planning and Work Conference now being held by the Ministry of Water Conservancy and Electric Power has reported that to meet the needs of industry and agriculture to quadruple their gross output value, the electric power industry must undergo tremendous growth. In the next 18 years, hydropower must be developed to its fullest potential. Emphasis will be given to developing the hydraulic resources of the middle and upper reaches of the Huang He and the Chang Jiang and their tributaries and on accelerating construction of Longyangxia in Qinghai, Tongjiezhi in Sichuan, Gezhouba in Hubei, Wujiangdu in Guizhou, and other large-scale mainstay hydropower stations. Construction of a number of medium-sized hydroelectric stations will also be undertaken. Concurrently, the construction of large-scale thermal power bases in coal-rich mountainous regions such as Shanxi, Nei Monggol, Shaanxi, western Henan, Huaibei and Huainan, southern Shandong, and Liupanshui will be stepped up. Nuclear power plants will be built in eastern China and Guangdong to meet the electricity requirements in areas with chronic power shortages. In farm villages and pastoral areas, suiting methods to local conditions, there will be diversification of power generating resources such as small-scale hydropower, small-scale thermal power, wind power, and geothermal power. Thermal power plants will be developed in urban areas. Due to China's pattern of generating power in the west and transmitting it to the east, we must develop large power grids with direct current transmission and transformer projects.

CSO: 4013/40

NATIONAL POLICY

SHANDONG ENERGY, TRANSPORTATION DEVELOPMENT IS PART OF OVERALL NATIONAL PLAN

SK090940 Jinan Shandong Provincial Service in Mandarin 2300 GMT 8 Oct 82

[Text] Recently a reporter interviewed Comrade (Liu Qingxin), director of the provincial construction committee, to discuss the issue of accelerating construction of key projects to boost the national economy.

Comrade (Liu Qingxin) said: Comrade Hu Yaobang's report to the 12th Party Congress stressed that in order to realize the strategic objective for the next two decades, we must firmly foster the idea of taking the whole country into account. The state must concentrate needed funds on key development projects in their order of importance and urgency, while making constant efforts to improve the living standard of the people. This decision is of great importance.

Comrade (Liu Qingxin) said: To guarantee key projects, attention should be paid to the infrastructure, such as energy and transport projects. We should make great efforts to attend to key energy and transport projects to lay a reliable foundation for the development of the national economy.

Comrade (Liu Qingxin) said: Unlike some general production construction, the construction of energy and transport projects involve a number of localities and departments, need large investment and take a long time--that cannot be undertaken by a locality or a department. In concentrating needed funds on key development projects, the state must encourage localities, departments and enterprises to make their funds available for the key projects most urgently needed by the state. We must urge all localities, departments and all enterprises to firmly foster the idea of taking the whole country into account and resolutely curtail funds for the general processing industry in order to transfer them to the needs of energy and transport projects. Firmly stop those projects which now are not urgently needed, are short of raw materials, fuel and motive force and under blind or duplicated construction. We should make concerted efforts to develop the weak link of energy and transport projects.

Comrade (Liu Qingxin) said to the reporter: In the period of the "sixth 5-year plan" and the "seventh 5-year plan," our province plans to construct some energy and transport projects. At present, some coal-producing bases, the projects of exploiting crude oil in the Shengli oilfields, the (Longkou) power-plant and the (Lunan) powerplant are under construction. The extension projects

of the (Wangtai) powerplant, the Shijiusou port, the Qingdao port, the Yanshi railway and the Jiao-Ji multiple railway tracks are being accelerated.

Those projects, in line with their order of importance and urgency, will change the situation of backwardness of energy and transport and lay a good foundation for the development of a new economy in the next 10 years.

So long as leaders at all levels throughout the province and cadres, staff members and workers of the capital construction fronts conscientiously implement the guidelines of the 12th Party Congress and work with unity, key projects will be guaranteed a smooth development so that we can make a new contribution to the implementation of the grand strategic objective.

CSO: 4013/29

POWER NETWORK

STRATEGY OF POWER SYSTEM DEVELOPMENT DISCUSSED

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 9, 5 Sep 82 pp 70-72

[Article by Fei Yiqun [6316 5042 5028]

[Excerpt] I. The Significance of Developing Power Systems

The inevitable trend in the electric power industry is the development of power systems. This is because developing power systems may reduce capital investment, accelerate capital construction, exploit energy resources rationally, reduce production costs, improve the quality of electric power and the reliability of power supply, and improve the labor production rate. The development of the power system has important economic significance.

1. The distribution of energy resources in China is very uneven, hydraulic resources are concentrated mainly in the southwest, northeast, and central China, coal resources are concentrated mainly in Shanxi, Nei Monggol and Henan, but the demand of electric power in the east is greater than that in the west and the eastern region has a storage of energy resources. In order to deliver the primary energy to the needy areas, extra-high tension AC and DC transmissions are desirable methods; they will form the backbone of large power systems.

2. Due to reliability requirements, the maximum capacity of generators of a power system is related to the generator capacity of the system. Only by enlarging the power system can we use large capacity, high efficiency and low cost-per-unit generators.

3. Petroleum and coal can be conserved by making full use of hydraulic power, but, because of hydrological constraints, the full benefit of the hydro-electric power can be derived only with the complement of thermo-electric power. In the development of large power systems, hydro-electric power bases of different rivers and different hydrological characteristics should be combined with large thermo-electric power bases in order to take advantage of load leveling and regulation among the river systems.

4. China has a vast territory with several time zones from the east to the west, different regions have different weather patterns, and power demand in industry and agriculture, hence the time of peak demand is different too.

By combining the power systems, we can take advantage of the staggered time for peak demand and improve the utilization rate of the generating facility.

5. In order to insure reliability of power supply to the users, each power system must have a certain percentage of spare generators. In a combined power system the capacity of spare equipment and the investment devoted to this purpose may be reduced while maintaining an equal level of reliability.

6. Developing power systems will also facilitate better economic management based on the technical and economic characteristics of different generators, reduce the power consumption and production cost for generation and insure the power quality.

III. Development Status of Power Systems in China

Since the Revolution, the power industry in China has made great progress. By 1981 there were 13 power systems greater than 1 million kilowatts and 6 of them were inter-provincial systems. Today, the capacity of the power systems in east China, north China and northeast China have all exceeded 8 million kilowatts. The highest transmission voltage in China is 500 kilovolts.

In order to meet the power demands of the four-modernizations, we imagine that, in the next decade, the 28 existing power systems of 100,000 kilowatts or greater will be gradually combined into 7 large interprovincial and inter-regional power systems according to the distribution of energy resources in China and the nation's energy policy. The existing power systems in northeastern China, east China, north China, northwest China and central China will be expanded and two inter-provincial power systems in southwest China and south China will gradually take shape. In addition, large inter-regional power systems of central and eastern China, and northwestern and northern China will also emerge. In about 10 years, the capacity of a number of these large power systems may reach 20 million kilowatts.

IV. Technological Policies for Power System Development

In order to develop, construct and manage large power grids in China, there must be technological policies to go along.

1. In developing power systems, there must be an overall vision which gives considerations to the composite equilibrium of energy resources in the whole country and not limited by regional and administrative divisions. In regions with abundant primary energy, attention should be given to delivering power to other regions. These regions should actively assume the construction task of delivering power to other regions and should not make satisfying local power needs their goal. For regions weak on energy resources, self-sufficiency should not be preferentially stressed and building too many uneconomic power stations should be avoided; instead, these regions should rely on the support of power systems in neighboring regions.

2. Power system development must be based on long-term economic considerations, each system should have a 10-20-year long-term plan and a 5-10-year system design. Annual plans should be dictated by system design requirements. Reliability and economic feasibility must be taken into account in the planning and design of all power systems.

3. When new thermo-electric generators are added to power systems, large capacity and high efficiency machines should be used whenever possible according to the actual situation of system capacity, rate of increase of load and system structure and under the pretext of maintaining a certain level of reliability. In general the maximum single-machine capacity of the new addition should not be less than that in the existing system. Table 1 is a guide for selecting the maximum generator capacity based on the reliability standard of the existing system.

Table 1.

<u>Present power system capacity</u> <u>(in 10,000 kw)</u>	<u>Maximum single-machine</u> <u>capacity to be selected</u> <u>(in 10,000 kw)</u>
25~60	2.5~5
60~200	10~20
200~300	20~30
300~750	30~60
800 and above	60 and above

4. In building power systems, attention should be paid to network structure and reliability. Under normal conditions, a network should have sufficient ability to deliver and distribute its full output to the load points; in case of accidents, it should be able to isolate the accident to the minimum extent possible; when an individual component in the network malfunctions, it should not affect the supply of electric power or affects it as little as possible; and the short circuit capacity of power systems at various voltages should be limited to below certain level.

5. The proper voltages should be chosen in developing a power system. The delivery voltage of a power plant or a large hydro- or thermo-electric base should be compatible with its eventual size and should generally maintain dual-loop delivery lines. Table 2 shows the delivery capacity of single loop delivery lines with a voltage of 220 kilovolts or higher, this may serve as a reference for voltage selection.

Table 2.

<u>Voltage</u> <u>(Kilovolts)</u>	<u>Single loop delivery capacity</u> <u>(10,000 kw x 100 Kilometers)</u>
220	45~50
330	130~150
500	300~400
750	800~1000

When the capacity of a power system doubles, it enters a higher voltage bracket. Table 3 shows the power network capacity and the corresponding voltage of the principal trunk line. In the long-term design of a power system, we should anticipate circuits of a new voltage bracket and make timely material and technological preparations for the introduction of a higher voltage bracket.

Table 3.

<u>Total machine capacity of the power system (in 10,000 kw)</u>	<u>Principal trunk line voltage bracket (kilovolts)</u>
below 400	220
400~800	330
800~1600	500
above 1600	750

6. A power system should have adequate load leveling ability. In addition to making use of hydro-electric systems with suitable reservoir capacity and vapor-condensation type thermo-electric system with a higher fuel cost, we may also consider making use of energy storage pump stations or expanding existing hydro-electric stations to bear the load leveling task or deploying thermo-electric generators specifically designed for this purpose.

Since most of the power systems today are already loaded beyond 85 percent, their potential for escalation is not great. Along with the four modernization construction and standard of living improvements, the electric utility structure will undergo changes and there is the possibility of a decrease in system load. In addition, because large capacity, high efficiency machines have a lower load leveling ability and generally can only carry the base load, the load leveling and frequency regulation ability of the system may decrease and no longer meet the needs of an increased demand. For this reason, attention must be given to the construction of load leveling and frequency regulation power sources in the development of power systems.

7. Because reactive source and voltage regulation method are the basis for maintaining the voltage quality of the power supply in a power system, considerations must be given to the construction of reactive source and voltage regulation facility in the development of power systems. Voltage quality and economic efficiency must be insured for a given user power factor. In order not to increase the over-voltage level of a power system, the charging power of an extra-high tension transmission line generally should not be used as a reactive source. In a power system with networks of different voltage, there should be one or several voltage regulation points and voltage monitor points in order to monitor the voltage quality, control the proper flow of reactive current and achieve a local balance of reactive power.

V. Necessary Investigations and Measures in Developing Power Systems

In order to realize the technological policy stated above, the following measures should be studied and employed:

1. The power industry management system should be studied. The present management system principally based on administrative region division should gradually be changed to a management system based on energy resources that is conducive to the development of the economic efficiency of the power systems. How to make this change and the steps to be taken need further study.
2. Research on the safe and steady operation of power systems should be strengthened. The disadvantage of a large power system is that a large area will be affected by any accident and it is more likely to have large area power outage and serious loss. But as long as we pay attention to the study of safety characteristics of the power system and seek out proper measures to prevent large area power outage, incidents may be avoided. When compared to the economic benefits it will provide, the cost required by such technical measures is very small indeed.
3. In collaboration with manufacturing sector and based on the development needs of power systems, we should develop timely new technological equipments that are high quality and low cost, including large hydro-electric and thermo-electric generators, AC and DC transmission and transformer facilities for the new voltage bracket, water pumping energy storage system, thermo-electric load leveling and frequency regulation machine system and reactive and voltage regulation devices.
4. The technical management standard of power systems must be improved as soon as possible in order to meet the needs of large power systems. Statistical and analytical work of various fundamental data should be strengthened and attention should be given to the accumulation of raw data.
5. Study of dynamic economics should be strengthened, including the integrated utilization of energy resources, pricing policy, user power factor management, changes in electric utility structure, effects on dynamic economics due to increased power utilization in agriculture, and power outage loss and reasonable compensation.
6. Technologies for AC and DC extra-high tension, large capacity, and long distance power transmission should be studied, as well as key problems in connecting large inter-regional power systems. The voltage level for extra-high tension power transmission should be determined as soon as possible.
7. Combine the readjustment tasks in the current electric power industry, improve the network structure and emphasize the improvement of the main network structure.

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CS0: 4013/1

POWER NETWORK

DEVELOPMENT OF EXTRA-HIGH TENSION POWER TRANSMISSION - OUTLINED

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 9, 5 Sep 82 pp 73-78

[Article by Hu Daoji [5170 6670 3444] of the Science and Technology Office, Ministry of Water Conservancy and Electric Power, and Wang Zun [3769 6690] of the Electric Power Institute, Ministry of Water Conservancy and Electric Power: "Development of Extra-high Tension AC and DC Transmission"]

[Excerpts] High tension transmission lines are an important component of a power network. High tension transmission not only delivers great quantities of electric power from the power plant to the user over large distances but also links isolated power plants and users to the network, thereby greatly improving the economy and reliability of power production and supply. In order for the power industry to develop rapidly and economically, we must establish a correct technological policy for high-tension transmission.

Up to the end of 1980, China had a power production capacity of 60.5 million kilowatts from power plants of 500 kw or larger, and 95,632 kilometers of transmission lines of 110 kilovolts or higher. In order to match the great increase in generation capacity and the ever expanding power network, we need to construct several tens of thousand kilometers of transmission lines with a delivery capacity of 1 million kilowatts by the end of this century. How to establish a sound development plan is an urgent topic of study.

China has the world's largest hydraulic reserve, but the resources are confined to southwest, central and northeast China. China's coal resources rank third in the world, but they are mostly concentrated in Shanxi, Henan and Nei Monggol. China's load of electric power is mainly in the industrially developed coastal area where there are no or little energy resources and the distribution of demand and resources is very imbalanced. In order to develop the energy resources effectively and utilize the electric power economically, we are forced to construct many long-distance, extra-high tension AC and DC transmission lines and gradually form a national power network. Therefore, the wise selection of network connection and transmission mode is an important issue. We must begin with a technological policy study for high-tension transmission, voltage, etc., and then make the correct choice.

I. Development History of High-tension Transmission and Power Network in China

In 1949 China had only 1.85 million kilowatts of power generation facilities; by 1980 it had reached 60.5 million kilowatts, an annual rate of increase of 11.9 percent, or a doubling of power output every 6.2 years on average. Today there are six inter-provincial networks that are 3.5 million kilowatts or greater and seven networks in the 1-3.5 million kw range. During the "6-5" period [Sixth 5-Year Plan], seven provincial regional networks will be built and perfected--these are in the northeast, northern, eastern, southwest, central, northwest and southern China--and loosely linked together. In the "7-5" period, construction will begin on several major transmission trunk lines, the linkage among large regional networks will be further strengthened, and finally a national power network will gradually take shape.

In the past 30 years, along with the development of power plants and networks, there have been great increases in transmission line length as well as voltage in high voltage transmission. In 1953 China independently designed and built 220 kv transmission lines in its northeast network and, after 1958, modified part of the 154 kv network into 220 kv lines and formed a 220/60 kv network. In the north China power network, there has been extensive construction of 110 and 220 kv transmission lines in addition to raising the voltage of the existing network; 220 and 110 kv networks have also been built in eastern and central Guangdong and Guangxi, and southwest China. Based on 110 kv transmission lines and combined with the development of the Liujiaxia hydroelectric power station, the northwest region achieved 330 kv transmission in 1972. Today, 500 kv transmission lines are being built to deliver the power from large power stations at mining sites and from the Gezhouba hydroelectric power station to load centers; the first 500 kv transmission line was put into operation during the 4th quarter of 1981. Extra-high tension transmission is under active study to meet the needs of developing remote hydroelectric resources and linking up the networks.

On the whole, the development of the transmission line voltage has been growing approximately proportional to the square root of the power delivered.

The four networks in northeastern, central, northern and eastern China have decided to adopt the 500/220/110(60) kv system; the northwestern network has already acquired the 330/220/110 kv system and the present system in the southwest and in Guangdong and Guangxi is 220/110 kv.

According to the present conductor cross-sectional area of transmission lines at various voltages in China and using the natural delivery power (based on 3,000~5,000 hours of peak load utilization and 1.15 A/mm^2 of economic current density) as a guide, the delivery power at different voltages should be roughly as follows: 40,000 kw at 110 kv, 175,000 kw at 220 kv, 360,000 kw at 330 kv and 1.2 million kw at 500 kv. As of December 1980, China had an equivalent of 8.03819 billion kw-km of high tension transmission lines above 110 kv (8.95019 billion kw-km counting the 500 kv circuit

under construction). Assuming a generation capacity of 60.5 million kw, the average delivery distance is 133 km and the step-down transformer capacity is 1.44 kv-A/kw.

Viewed as a whole, the Chinese power network is flawed by a weak structure and a slow development in transmission voltage. As a result, the power network cannot keep up with the development of power plants. Some large power plants are connected only into the system and not into the power network. Another problem is the link-up of long-distance single-loop transmission lines.

In the future the power industry construction in China should emphasize the development of power plants at mining site and hydroelectric power stations, especially regenerative hydroelectric resources.

The principal area of power supply of the seven cross-provincial networks is generally 1,000 km, and the largest network capacity in China today is 9 million kw. Major hydroelectric power plants to be built for now and in the future include Gezhouba in Hubei, the Ertan, Jinping and Xiangjia dams near the Sichuan and Yunnan border, Longtan and Tianshengqiao in Guangxi and Guizhou, Longyangxia on the upper reaches of the Huang He and the cascade power stations below it; the generation capacity is mostly 2 million kw or more. Large power plants to be built at the mineshaft openings of the Shanxi and Hei Monggol coal mines will have a capacity in the 1.50~2.50 million kw range. Five hundred kv transmission lines will suffice to serve as the skeleton of regional power networks. For the nationwide combined network, however, extra-high tension DC transmission will be more economical and sensible in view of the long distance (1,000~1,500 kilometers or even 2,000 kilometers) of transmission and the requirement to have the least number of touch-down points.

Table 1 shows the specific construction costs (per 10,000 kw-km) of different voltage transmission lines in China. As can be seen, when the power is delivered at the economic delivery capacity, the construction cost decreases as the transmission line voltage increases. Using 220 kv as a baseline, the specific construction cost for 330 kv is 77 percent and the actual construction cost for 500 kv is 50 percent. Even taking into account the fact that in the development stage of the 500 kv network the delivery power is lower and $3 \times 300 \text{ mm}^2$ conductors are used, the specific cost of construction is still only 59 percent. The specific cost of construction of the 500 kv circuit is 22~35 percent lower than that of the 330 kv circuit.

Table 1. Specific Construction Costs of Different Voltage Transmission Lines

Voltage (kv)	Conductor cross-section (mm ²)	Cost (10,000 yuan/km)	Economic delivery capacity (10,000 kw)	Specific cost (yuan/10,000kw-km)	Comparative cost (%)	
110	185	2.7	4.0	6,750	260	200
220	400	5.9	17.5	3,370	131	100
330	2x300	9.3	36.0	2,580	100	77
500	4x300	16.5	120.0	1,380	53	41
500	4x300	20	120.0	1,670	65	50
500	3x300	18	90.0	2,000	78	59

Note: Construction cost for 500 kv circuit itself is 180,000~190,000 yuan/km, and the composite cost is 250,000~280,000 yuan/km. If the extra cost is figured into the cost on a 10-year installment plan, it is about 6,000~10,000 yuan/km, or the actual composite cost is 18,600~20,000 yuan/km. Computation used 20,000 yuan/km.

III. Policies Regarding High-tension Transmission

1. Voltage Serial in the Seven Cross-provincial Networks

The seven cross-provincial networks each serve approximately a 1,000 kilometer area; by the year 2000, the capacity of these networks is estimated to be 20~40 million kilowatts and 500 kv should suffice.

A 500/220/110(60) kv serial will be formed in the four networks in northeast, northern, central and eastern China.

The northwest network has plans to upgrade its 330 kv circuit. Hydroelectric resources in the three northwestern provinces include Longyangxia, Liji Xia, Laxiwa, Bogongxia, and Jiyouxia, all in the vicinity of Xining City in Qinghai Province; the capacity is 7.6 million kilowatts and the delivery distance to Guanzhong is about 600~800 kilometers. For this network capacity and delivery distance there will be a dozen parallel lines at 330 kv running to the east. In the present condition, in case of an extra-high water level like that in 1981, even with most of the thermoelectric power plants in the northwest network shutdown, Liji Xia will still have to abandon water. It is expected that in the sixth and seventh five-year plans, hydroelectric power may be delivered to the north China network at a distance over 1,000 km, 330 kv may already be inadequate. If the northwest network were to adopt a higher AC voltage, would it be 500 kv or 750 kv? If DC voltage were used for power delivery to the north China network, what should be the voltage? These are topics for early study and design plans should be made in order to avoid later modification at high costs.

The present voltage in the southwest network is 220/110 kv. Hydroelectric power resources in the southwest is very rich and large amount of hydroelectric power will be delivered in the future. Delivery distance in this network is 300~600 km and the delivery is expected to require 500 kv.

The south China network current has a smaller capacity by the delivery distance of the Hongshui He hydroelectric power to Guangzhou is 800~1,000 km and it is obviously more economic to use 500 kv instead of 330 kv. The hydroelectric power of Tianshengqiao may even be delivered to Guangzhou with DC. These two networks are expected to form a 500/220/110 kv voltage serial.

In the discussion of transmission voltage, the opinion of developing 500 kv voltage is unanimous, but there are different opinions about whether all networks should use 500 kv, except the northwest network which already has 330 kv. These decisions should all be made based on the current specific situation and long-term planning and technological and economic comparisons.

2. Method of Connecting the Networks

China's hydroelectric resources are mostly located in the southwest and coal bases are mostly in Shanxi, Nei Monggol and Henan. Great amounts of electric power needs to be delivered to the east over 1,000~1,500 km distance. The seven cross-provincial networks should also be gradually combined to form a nation-wide network. The problem of selecting a proper connection method is an important issue.

In extra-high tension DC delivery, the equivalent distance for AC and DC delivery has been shortened to 500~700 km due to the deployment of silicon controlled switches and great improvements in switching facility reliability made in recent years. Another advantage for DC delivery is that it does not have instability problems. Using extra-high tension DC delivery in connecting the nation-wide network is worth study in order to avoid low frequency oscillations which may appear in the AC linkup of networks and affect the safe operation.

3. Keeping Construction Costs of Transmission Lines as Low as Possible

In transmitting electric power from power plants at the hydroelectric and mining sites over a long distance, the delivery cost will be 15~30 percent of the construction cost, the transmission line building cost will affect the results of technological and economic comparison and the outcome of the voltage selection.

Power transmission at 500 kv has great development potential, but in the initial phase of developing these networks, the transmission power often cannot reach the natural power, this is an objective rule for network development. If the separation between adjacent voltage levels is reduced, it will invariably lead to an excessively complex voltage order even though there will be more flexibility in the construction process. In order to minimize the total investment and tedious modification of the entire network, the network plan must reconcile short-term and long-term considerations so that the power transmission development precedes the power plant construction and long-term development is dealt within the economic constraints.

In view of the actual development of the early phase 500 kv network, two types of 500 kv circuits should be designed: for large capacity power transmission (such as power delivered from the Gezhouba hydroelectric power plant), the cross-sectional area of conductors should be chosen on the basis of the transmission capacity; for the present small capacity but long distance circuits, small conductors should be used while satisfying corona and interference conditions. With insulation modifications, the small conductor is expected to reduce the construction cost per kilometer by 20 percent. As the network develops, problems with substation and voltage step-up will no longer exist, which will in turn save some initial investment and promote the development of 500 kv networks.

In developing the power network, attention should be given to the following problems in order to reduce construction cost and improve safety: 500 kv post tower lines are too far apart, the steel towers are too heavy and some of the component structure needs improvement; more stay towers should be used as they require 3 less tons of steel than the stand-alone towers; construction costs have been reduced in 330 kv circuits by using pre-stressed concrete posts, the drawback is that the wind load along the line is slightly inadequate and in the future a reinforcing tower should be used in each base and circuits of 220 kv or less should use more concrete posts and pre-stressed concrete posts.

Interference problem of wired communication by the power lines should be solved mostly through protective measures that are technologically and economically feasible, for example, measures should be taken to restrict the short circuit current and dischargers should be installed on communications lines.

4. Simplifying the Voltage Order in Present Networks

In China power networks have 6 voltage levels at 6, 10, 35, 66, 110 and 220 kv. A few circuits use 3, 44, and 154 kv. After 20 years of voltage increases and improvements, the northeast network has been basically consolidated into three voltage levels at 220/66/10 kv. The north China network has been modified to run at four voltages of 220/110/35/10 kv.

In the process of network development, higher voltages gradually emerge as the capacity increases. When networks are developed to a certain level, they begin to suffer from such disadvantages as too many voltage levels, too much repetition, excessive length of line and line loss, frequent accidents and lack of flexibility. It follows that simplification of the voltage structure and modification of old networks are the inevitable rule of network development.

In supplying power to the major cities, the plan should settle on some standard voltage serial (such as 220/10 kv or 110/10 kv) based on the area of service and the load density. In some large cities with greater load density the possibility of using 20 kv to replace 10 kv should be studied in terms of technological and economic feasibilities. The voltage structure

should be simplified whenever possible in the construction and modification of the networks and it should be gradually unified as a standard serial. In the modification of networks, voltage increases should be given the priority whenever possible in order to improve the service ability.

When high voltage electric power is introduced to a concentrated load point, large amplitude voltage step-down is an effective means to reduce staggered voltage structure. When limited by space, circuits at 220 kv or lower should use dual return or multiple return installed on the same post frame.

5. Miniaturizing Substations To Reduce Their Ground Area

By using closed devices the ground area of 220 kv substations and switching stations may be reduced down to 10~20 percent of the conventional area and for 550 kv the reduction may reach less than 10 percent. Fully closed and semi-closed devices may be considered for hydroelectric power stations limited in ground area, substations in coastal and heavily polluted area, and substations taking in high voltage electric power.

IV. Selected Topics for Scientific Research

1. Second Generation 500 kv Tower Post

(1) Statistical computation to match insulation, including limiting the working frequency voltage increase to 1.1~1.3 by using controlled reactor, limiting operation overvoltage to less than a factor of 2; measuring and computing the conductor wind deflection angle; using large diameter insulator; improving voltage of long string insulators and shortening the length of insulator and operating air gap.

(2) Selection of minimum conductor cross-sectional area, including corona loss, radio interference, calculation of electric field strength at ground surface for new number and arrangement of conductors, and the section of ground to conductor height.

(3) Design, test production, stress test and electrical property test of second generation 500 kv tower posts. Carry out designs according to insulation distance, height above ground, number and cross-section of conductors determined in (1) and (2).

2. Extra-high Tension DC Power Transmission

(1) Corona loss, radio interference, television interference, audio noise, conductor cross-section, and DC electric field effects.

(2) Standard of insulation, including insulator and air gap, and transformer insulator and air gap.

(3) Research and development of DC power transmission equipments.

3. Study of Compact Substations

- (1) Manufacture and operating characteristics of SF₆ closed transformer.
- (2) Research and production of ZnO lightning arrestor.
- (3) Research and test of composite insulator.

4. Ultra-high Tension Power Transmission Technology

Note: Comrades Xu Shigao [1776 1102 7559], Chen Deyu [7115 1795 5940], Xu Bowen [1776 0590 2429], Sheng Changda [4141 2490 6671] and Xu Yin [6079 7336] have reviewed and discussed the manuscript.

9698

CSO: 4013/1

POWER NETWORK

CONDITIONS SAID RIGHT FOR RAPID GROWTH OF HEILONGJIANG POWER INDUSTRY

SK040546 Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 3 Nov 82

[Talk by Cui Qingshi, director of the provincial power industrial bureau:
"Strive To Create a New Situation in the Power Industry to Keep Abreast of the
New Situation in Industrial and Agricultural Production"]

[Summary] "The power industry is an energy industry as well as a vanguard industry of the national economy. With the vigorous support of the CPC Central Committee, the provincial CPC Committee and people's government at all levels, our province's power industry has made tremendous progress and power output has doubled and redoubled since liberation. However, many new changes have taken place in the structure of power consumption thanks to the development of the national economy. Many departments now consume more power and [words indistinct]. Moreover, household electrical appliances have developed very rapidly in recent years. Consequently, power consumption has been increasing steadily and power has been in short supply for many years."

We must upgrade the power industry if we are to put an end to this strained power supply and to quadruple the province's industrial and agricultural output by the end of the century. The power industry must go ahead with other undertakings. By the end of the century the province's output should increase from 12.78 billion kwh in 1980 to 60.5 billion kwh, an annual increase of 7.94 percent. The installed capacity should increase from 2.27 million kw to 11.15 million kw, an annual increase of 8.28 percent. Judging from the development of the province's power industry and the favorable conditions at present, this goal stands an excellent chance of success. First, the province's power output, at 199 million kwh in the year after liberation, increased by 63 times to 12.78 billion kwh in 1980, averaging an annual increase of 14.4 percent. Second, economic development, which has suffered many setbacks in the past 30 years, will be free of such setbacks in the next 2 decades. Third, our province has verified coal reserves of 15.7 billion tons and water power reserves of 7.43 million kw, of which 5.9 million kw remains untapped.

CSO: 4013/46

POWER NETWORK

BRIEFS

HEILONGJIANG POWER TRANSMISSION LINES--Harbin, 15 Sep (XINHUA)--Heilongjiang Province is stringing three 110,000-volt power transmission lines totaling 812 kilometers in the province to link other lines and form a power network. According to the provincial Power Industry Department, the three high-voltage lines, from Mudanjiang City to Shangzhi County, from Qiqihar City to the provincial capital of Harbin, and from Qiqihar City to Beian County, are scheduled to be completed before the end of next June. Helped by the state, Heilongjiang has built a number of new power plants since 1979 with the generating capacity rising from 1.42 million kilowatts now. Over 100 million yuan have been allocated for building power transmission projects to cope with the construction of new power plants over the past 3 years. Eleven 110,000-volt transmission lines have already been completed and 12 substations newly built or expanded. [Text] [OW231201 Beijing XINHUA in English 0701 GMT 15 Sep 82]

ZHEJIANG POWER TRANSMISSION LINE--Hangzhou, 2 Oct (XINHUA)--A 220,000-volt power transmission line was completed recently in southern Zhejiang Province. This is the second such line completed this year in the province, according to the Zhejiang Power Supply Department. The line, 201.5 kilometers long, extends from the Taizhou thermal power plant now under construction to the Fuchun Jiang hydropower plant and links up with the east China power grid. The first line, completed on 30 June, extends 204 kilometers from Xiaoshan, Zhejiang Province, to Changzhou, Jiangsu Province. Zhejiang Province has over the past 5 years built eight 220,000- and 110,000-volt transmission lines, with a total length of 1,000 kilometers. [Text] [OW021302 Beijing XINHUA in English 1210 GMT 2 Oct 82]

HUBEI ELECTRICITY TRANSMISSION PROJECT--The first phase of the 220,000-volt electricity transmission project from (Fenghuangshan) in Wuchang to (Xinxialu) in Huangshi was completed and put into operation on 1 October. The main part of this project includes the installation of 200,000 volt electricity transmission lines 56 km long, and the construction of a large transformer station with a capacity of 150,000 kilovolt-amperes. This project was designed by the Zhongnan Power Design Institute and was constructed by the Huangshi Electricity Supply Bureau and the No 3 Hebei Provincial Power Department. Huangshi Municipality is an important base of industrial raw materials in the province and uses a very large amount of electricity. After this project is completed and put into operation, the municipality can make full use of the large amount of electricity supplied by the Gezhouba power plant. [HK060928 Wuhan Hubei Provincial Service in Mandarin 1100 GMT 4 Oct 82]

HEILONGJIANG POWER INDUSTRY PROGRESS--According to statistics disclosed by the director of the Heilongjiang Provincial Power Industry Department when he briefed the station reporter, in the period right after the PRC's founding, the province's installed capacity was only 172,000 kw and its power capacity was 199 million kwh. As of 1982, its installed capacity has reached 2.27 million kw and its power capacity, 127.8 billion kwh. The province has scored 12.2-fold and 63-fold increases respectively in its installed capacity and power capacity over the figures in the early period of the PRC's founding. The annual increase has been 8.7 and 14.4 percent respectively. [Harbin Heilongjiang Provincial Service in Mandarin 1100 GMT 19 Oct 82]

SHANDONG POWER GENERATION--Shandong Province overfulfilled by 50 million kwh its third quarter power generation task. From January to September, the province generated 15.9 billion kwh of electricity, 5.4 percent more than in the corresponding 1981 period. [Jinan Shandong Provincial Service in Mandarin 2300 GMT 1 Oct 82]

LIAONING POWER GENERATION--By 30 September, the Dongbei [northeast] power grid had overfulfilled its power generation task for the 9 months of this year by producing 90 million kwh of electricity more than planned. During this period, it also saved 120,000 tons of standard coal and 230,000 tons of oil. Because of a water shortage, hydropower stations reduced their production by an average 6 million kwh a day. However, efforts were made to enable thermal power stations to increase their production by 3 million kwh a day. [Shenyang Liaoning Provincial Service in Mandarin 1100 GMT 1 Oct 82]

GANSU POWER PRODUCTION--In the first 9 months of 1982, power departments throughout Gansu Province overfulfilled the power generation quota by 830 million Kwh, a record high. As of 28 September, the province had generated 9.74 billion kwh of electricity, 82 percent of the annual target and increase of 11 percent over the corresponding 1981 period. [SK040001 Lanzhou Gansu Provincial Service in Mandarin 1125 GMT 2 Oct 82]

NEW GUANGDONG POWER LINE--The 110,000-kilovolt high-tension transmission and transformer project from Xinfeng and Longmen to Zengcheng formally began operations yesterday. Yesterday morning, Comrade Liang Lingguang officiated at a ribbon-cutting ceremony in Zengcheng to celebrate the completion of the project. "This project is a project handled very quickly, very well and very economically by our city and constitutes an important part of our effort to create new prospects for the building of socialist modernization," he announced. This 110,000-kilovolt high-tension transmission and transformer project began in October of last year and the construction phase took only 10 months. The system was tested at the end of August of this year. The completion of the project will enable the small-scale hydropower stations of Xinfeng and Longmen to feed more than 20,000 kilowatts of unused electric power into the larger provincial grid, supplying electricity to Zengcheng, and earning more than 5 million yuan a year for the two mountain counties of Xinfeng and Longmen. Also, the more than 100 million kwh now fed into the power network of Zengcheng by the Huangpu Power Plant may be diverted for industrial production in

the Guangzhou municipal area. This is a project that, upon completion, will see immediate economic benefit. These two mountain counties have 200,000 kilowatts of exploitable hydraulic power resources and have already constructed small-scale hydropower stations with an installed capacity of 46,000 kilowatts, leaving three-fourths of this resource to be developed. [Text] [Guangzhou GUANGZHOU RIBAO in Chinese 1 Oct 82 p 1]

YUNNAN 110,000-KV TRANSMISSION LINE--The 110,000-kilovolt high-tension power transmission line from the Xunjiansi Power Plant to the Yuxi transformer station began operations on 31 August to complete the north-south coordination plan. After a complete overhaul of the Yuxi transformer station, the Xunjiansi Power Plant can supply 400,000 kwh daily to the central Yunnan power grid, basically meeting the power needs of the Yuxi area and easing the overload now on the central Yunnan grid. The transmission line has a total length of 85.5 kilometers and forms a bridge between the central Yunnan grid and the southern Yunnan grid. [Text] [Kunming YUNNAN RIBAO in Chinese 5 Oct 82 p 1]

CSO: 4013/58

NEW TECHNOLOGY

USE OF FLUIDIZED-BED BOILERS AS A NEW MEANS OF COMBUSTION PROMOTED

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82 pp 1-3, 8

[Article by Sun Jian [1327 6943] of the Northeast Power Institute: "As a New Type of Combustion Method the Fluidized-Bed Boiler Should Be Continually Popularized and Used"]

[Text] Recently, there have been different views on whether the fluidized-bed boiler should be popularized and used. According to my own experience over many years in the study of fluidized-bed boilers and the results of investigations, the answer to the question whether this new method of combustion, the fluidized-bed boiler, should be popularized and used, is affirmative.

First, although our nation's superior quality coal, petroleum and natural gas resources are very rich, the distribution of these resources is uneven, and they are especially difficult to mine and transport. Therefore, fully utilizing inferior quality coal, waste coal rock, oil shale and such low thermal value fuel produced locally has become one of the long-range policies of rational utilization of energy resources. The nation's coal mines have accumulated over 1 billion tons of waste coal rock, and each year they produce 50,000,000 to 60,000,000 tons of waste coal rock. The reserves of bone coal in the provinces south of the Chang Jiang are very large. In Zhejiang, Hunan and Hubei provinces alone, the reserves are over 35 billion tons. The amount of heat that can be produced is generally 1,000 to 2,000 kilocalories/kilogram. The reserves of inferior lignite in the three provinces of Hunan, Hubei and Jiangxi amount to 3.63 billion tons. The reserves of oil shale in the three provinces of Jilin, Liaoning, and Guangdong total 29.7 billion tons. The reserves of lignite in the five provinces of Liaoning, Heilongjiang, Jilin, Guangdong, and Yunnan amount to 350,000 billion tons [sic, possibly 35 billion tons]. These massive amounts of fuel of low thermal value could not be used effectively in the past because of limitations in combustion techniques. The successful development of the fluidized-bed boiler and its popularization and use enabled the regions producing low thermal value fuel to fully utilize local resources, conserve superior quality coal and oil imported from far away places, promote the development of local industries, and reduce the transportation burden of the state to supply good coal and oil. Regions producing superior quality coal could fully utilize waste coal rock and inferior coal. A new direction has been found for conserving coal by boilers near coal mines and mining regions, and a new path has been opened for the comprehensive utilization of waste coal

rock to change waste into treasure and to change the harmful into something beneficial. The whole nation's coal mining system now has 482 fluidized-bed boilers of 3,200 steam tons. Each year, they burn 2.5 million tons of waste coal rock and inferior coal, conserving 1 million tons of superior quality coal. Jilin Province now has over 700 fluidized-bed boilers. They burn the province's lignite, waste coal rock, oil shale and inferior bituminous coal. For over 10 years, they have conserved 4 to 5 million tons of superior quality coal for the state and have guaranteed the continued development of local industries.

The popularization and use of the fluidized-bed boiler has opened a new path to improve energy conservation of old style industrial boilers and to burn low thermal value fuel. The experience at all the localities shows that various types of stratified combustion boilers, coal powder boilers and oil-fired boilers can all be converted to fluidized-bed boilers. Up to the present, there are about 2,200 fluidized-bed boilers that have been newly built or have been converted from old style boilers. They produce over 13,200 steam tons.

These fluidized-bed boilers burn about 15 million tons of waste coal rock and various types of inferior coal and oil shale which can conserve and replace 6 million tons of superior quality coal. They have also guaranteed production needs and the development of heat supply for many users who lack superior quality coal. They have conserved superior quality coal, guaranteed production and guaranteed heating.

Second, the technology of medium and small fluidized-bed boilers has basically matured. As a new type of boiler, the fluidized-bed boiler is in the developmental stage, and it cannot be said to be perfect. In particular, some years ago, users converted stratified combustion boilers, coal powder boilers, and oil-fired boilers into fluidized-bed boilers or manufactured fluidized-bed boilers themselves. They were limited by the structure of the original boiler, the conditions at the plant, and technical levels. The structural shape of the boilers was not entirely rational, and there was a lack of matching auxiliary equipment and experience in operation and management, thus ignition of some fluidized-bed boilers was difficult, thermal efficiency was low, they consumed too much electricity, they could not operate continuously for long periods, environmental pollution by fly ash was serious. In a definite degree, these factors have affected the popularization and use of fluidized-bed boilers. In fact, some of these problems have already been solved or have been basically solved by many specialized scientific and educational workers and scientific experiment teams of a mass character after continuous research and improvement over the past dozen years. Effective measures to solve some of these problems have already been found. Our nation has developed a rational type of boiler and a ventilation structure that can guarantee stable boiling and combustion of various types of low thermal value fuel for long periods. We have measured many design and operational data. Many boiler workers have created various methods for quick ignition and methods that can guarantee that various types of fluidized-bed boilers can smoothly begin operation. Methods that regulate operation and handle breakdowns and that are suited to the characteristics of various types of fuel have been found in practice. A relatively rich experience in operation and management has been accumulated. Scientific and educational workers have already compiled a method of calculating the heat of combustion of the industrial boiler on the basis of summarizing the achievements in

scientific research, experiments and operation. In recent years, all fluidized-bed boilers, whether they are rebuilt from old style boilers or newly designed and manufactured, can be smoothly ignited and can operate in a stable manner. Fluidized-bed boilers have reached the designed requirements after specialized scientific and educational personnel and workers combined their efforts and after they carefully designed and manufactured the boilers. There are many boilers that need to be ignited only once to begin normal operation. The more than 2,200 fluidized-bed boilers currently available throughout the nation are mainly used by coal mines, small chemical fertilizer plants, light chemical industries and northern business units to provide heat. They can all burn low thermal value fuel produced locally in a stable manner. The regulatory function and continuous operating time not only satisfy the requirements of ordinary industrial use of steam and for heating, they can also be accepted by small power plants. The Jiangmen Glycerin Chemical Plant in Guangdong uses a fluidized-bed boiler that burns 50 tons/hour of inferior quality coal to produce 3,000 kilocalories/kilogram. The longest continuous period of operation was over 3,000 hours, and the cumulative number of hours of operation has surpassed 5,000 hours. The 35 tons/hour fluidized-bed boiler of the Nijiangkou Experimental Bone Coal Power Plant at Yiyang in Hunan uses bone coal with a thermal value of 900 to 1,000 kilocalories/kilogram. It has continually operated for 1,126 hours (the largest 136 tons/hour fluidized-bed boiler in the United States operates continuously for only 50 hours). The boiler has basically reached design parameters. This shows that China's fluidized-bed boilers have already developed towards medium power generation. Medium and small fluidized-bed boilers have advanced from those rebuilt or manufactured by the users themselves to specialized production by boiler manufacturers. On the basis of summarizing the mass experience in manufacturing some industrial boilers, various types of fluidized-bed boilers using low thermal value fuel have already been manufactured. Product evaluation and tests show the output and thermal efficiency of the boilers have both reached the standards stipulated by the First Ministry of Machine Building. They are now being batch produced and supplied to users. In the course of continued research and improvement, some new types of fluidized-bed boilers that have a higher thermal efficiency have emerged. For example, the double bed fluidized-bed boiler designed by Zhejiang University has a thermal efficiency of over 70 percent when burning inferior quality coal with a thermal output of 2,000 kilocalories/kilogram. It has also explored new directions in improving thermal efficiency of large fluidized-bed boilers. The thermal efficiency of the 10 tons/hour anthracite fluidized-bed boiler successfully developed by the Longhai Synthetic Ammonia Plant in Fujian has surpassed 80 percent. The lignite fluidized-bed boiler that has an external and internal horizontal circulation of air and a complete combustion chamber designed by the Northeast Power Institute and the Harbin Industrial University has been tested for nearly 10 years and its combustion efficiency has reached over 96 percent, its thermal efficiency has surpassed 85 percent, and it has been popularized and used in Jilin and Liaoning provinces.

Therefore, it can be said that our nation has already grasped the design, manufacturing, installation, ignition, testing and operation of medium and small fluidized-bed boilers.

Third, the fluidized-bed boiler can utilize low thermal value fuel of the locality near coal mines and mining areas and areas producing low thermal value fuel. This is not only technically feasible, it is also economically rational. Because fluidized-bed boilers burn low thermal value fuel, the thermal output is low and the ash content is high. To obtain the same amount of heat, consumption is larger, there are more cinder and ash, the amount transported is larger, the amount of work in crushing is larger, the equipment system is more complex, the initial investment and the cost of maintenance are all higher than stratified combustion boilers using better quality coal. But because the cost of shipping fuel over short distances is low, the total cost of the fluidized-bed boiler to produce 1 ton of steam (including fuel, water and electricity, manpower, depreciation of equipment and plant, maintenance and major repairs, cost of removing slag and dust) is lower than that of the stratified combustion boiler and the coal powder fired boiler burning superior quality coal. It can be seen from this information that the total cost of producing 1 ton of steam by the fluidized-bed boiler is 2.46 to 4.25 yuan. That of the stratified combustion boiler is 4.44 to 8.8 yuan, and that of the coal powder fired boiler is 3.76 to 5.08 yuan, i.e., the total cost to produce 1 ton of steam by the fluidized-bed boiler is lower than that of the stratified combustion boiler by 2 to 4 yuan and lower than that of the coal powder fired boiler by 1 to 2 yuan.

The Fangshan Mine of the Beijing Mining Bureau originally used two 140-horsepower Lancashire boilers. The total output of steam was 4.38 tons/hour. It burned superior quality lump anthracite (34.6 yuan per ton). Each year, the boiler operated for 4,700 hours, burning a total of 3,240 tons of fuel at a cost of 112,104 yuan (5.45 yuan/ton of steam). The cost of water and electricity, manpower and maintenance was 32,097 yuan (1.55 yuan/ton steam). The total operating cost was 144,201 yuan/year, the total cost per ton of steam was 7 yuan. To conserve good coal and satisfy the needs to develop production, the mine changed to the use of a fluidized-bed boiler producing 6 tons/hour of steam in 1972. It burned waste coal rock (7 yuan per ton). Each year, the boiler operated for 5,625 hours and burned 11,244 tons of fuel at a cost of 78,708 yuan (2.33 yuan/ton steam). The cost of water and electricity, manpower and maintenance was 54,625 yuan (1.62 yuan/ton of steam). The total operating cost was 133,333 yuan/year. The total cost per ton of steam was 3.95 yuan. This shows the total cost to produce 1 ton of steam by the fluidized-bed boiler was 3.05 yuan less than that by the Lancashire boiler, a drop of 43.6 percent. The two Lancashire boilers produced 20,589 tons of steam a year. After replacing them by the fluidized boiler, 62,787 yuan could be saved a year. The total investment in one fluidized-bed boiler with an output of 6 tons/hour (including the plant's internal facilities) is less than 200,000 yuan and the investment can be recovered in about 3 years.

The Shengli Mine of the Fushun Mining Bureau has five Babcock chain grate boilers burning superior quality raw coal (19 yuan per ton). Each year, the boilers operate for 3,600 hours and burn a total of 18,000 tons at a cost of 342,000 yuan (2.97 yuan/ton of steam). The cost for water and electricity, manpower, slag removal and transport, charges for removing surplus dust, equipment inspection and repair is 73,960 yuan (0.64 yuan/ton of steam). The total operating cost is 415,960 yuan. The total cost per ton of steam is 3.61 yuan. The mine built two fluidized-bed boilers producing 10 tons/hour beginning in 1976. The

boilers burned boiling coal (6.2 yuan per ton) with a thermal output of 2,736 to 3,200 kilocalories/kilogram. Each year, the boilers operated for 3,600 hours burning a total of 14,400 tons of fuel at a cost of 89,280 yuan (1.24 yuan/ton of steam). The cost of water and electricity, manpower, removal and transport of slag and surplus dust, equipment inspection and repair, and depreciation of equipment was 87,530 yuan. Total operating cost was 176,810 yuan. The total cost per ton of steam was 2.46 yuan. The total cost per ton of steam of the 10 tons/hour fluidized-bed boiler was 31.9 percent lower than the 6.4 tons/hour Babcock chain grate boiler, and 5,936 tons of raw coal was saved. The two 10 tons/hour fluidized-bed boilers required a total investment of 240,433 yuan and the investment could be recovered in 3 years.

The Power Plant of the Yongrong Mining Bureau in Sichuan originally used five boilers with tumbler boiler slag removers and chain grate removers. The thermal efficiency of the boilers averaged 55 to 60 percent. The consumption of coal was high, and superior quality coal had to be used for normal electric power generation. The cost of electric power generation reached 116 yuan per kilowatt-hour. Losses were serious. In 1975, losses amounted to 140,000 yuan. From 1975, four boilers were rebuilt into fluidized-bed boilers one after the other. They burned washed medium coal and pulverized waste coal rock. Because the thermal efficiency of the boilers was high (over 70 percent), the fuel cost was low, the cost of generating electricity dropped greatly, and losses were changed to profits. A total profit of 7.26 million yuan was realized from 1976 to 1980.

The coal mining system of the whole nation now has 482 fluidized-bed boilers with an output of 3,200 tons of steam. Operating an average of 2,400 hours a year, they produce 7.68 million tons of steam a year. Calculating at an average savings of 1 to 2 yuan in total cost per ton of steam, an average of 11,520,000 yuan per year could be saved. In addition, these fluidized-bed boilers burn 2.5 million tons of waste coal rock each year and save the nation 1 million tons of raw coal, equivalent to actually saving more than 110 million yuan of state funds each year. At present, the fluidized-bed boilers of the coal mining system generally have a low level of management, and auxiliary equipment consumes too much energy because "large horses are used to draw small carts." The structural type of the boilers does not suit the types of coal and the thermal efficiency is not high (averaging about 60 percent). The thermal efficiency of fluidized-bed boilers will greatly improve and electricity consumption will be greatly reduced, and greater economic benefits will be realized by strengthening management, training personnel, improving the structural type of the boilers, substituting highly efficient blowers and matching auxiliary generators.

In regions producing low thermal quality fuel, the fluidized-bed boiler has a higher thermal efficiency than the stratified combustion boiler and the pulverized coal-fired boiler in burning lignite, inferior quality bituminous coal, and oil shale, and it can save fuel and reduce production costs. The fuel for industrial boilers rationed by Jilin Province is basically lignite with a thermal output of less than 3,500 kilocalories/kilogram and inferior quality bituminous coal. The efficiency of this type of fuel burned in ordinary stratified combustion boilers is over 80 percent. The total cost per ton of steam is 4 to 6 yuan. The total investment in building one 6 to 8 tons/hour fluidized-bed boiler is about 200,000 yuan. It can save 2,000 to 2,500 tons of coal a year, and the investment can be recovered within 2 to 3 years.

Fourth, fly ash produced by some of the fluidized-bed boilers currently available in our nation indeed pollute the environment rather seriously. This has caused dissatisfaction among the masses living nearby. The reasons are: 1. Some boilers are not equipped with effective ash removal equipment. 2. Although some boilers have ash removal equipment, but management is poor or there is nobody to manage it, and it does not function as it should in removing ash. 3. Some boilers do not properly handle fallen powder and dust, creating a second source of pollution. In general, the problem of eliminating smoke and removing dust was not emphasized enough in the past. In recent years, under the guidance and supervision of environmental protection departments, many units have emphasized this question and have installed various types of dust removers for fluidized-bed boilers, therefore pollution by fly ash has been greatly reduced. The concentration of some of the dust released has reached or approached the national limits. Most can be accommodated by the environment and the masses are now more satisfied. Every fluidized-bed boiler of the mines of the Beijing Mining Bureau has been equipped with a new type of multi-tubular dust remover. They have been acclaimed by the masses living nearby. The fluidized-bed boiler of the private power plant of the Yongrong Mining Bureau in Sichuan is equipped with a permanent film dust remover made by the power plant itself from bricks. The fluidized-bed boiler of the Shigejie Coal Mine at Luan in Shanxi uses a foam dust remover built by the mine. They have all reduced the concentration of smoke released to a level approaching the state standards for the release of pollutants. These cases show that as long as we strengthen management, the problem of environmental pollution by fly ash can be solved.

It is worth pointing out that the fluidized-bed boiler is a type of low temperature combustion boiler. The amount of nitrogen and chloride compounds produced (NO_x) is far less than that of ordinary stratified combustion boilers and pulverized coal-fired boilers, and while burning coal in the boiling bed, limestone and mica are added to remove sulphur oxides (SO_2 , SO_3) in the smoke. The fluidized-bed boiler is the best boiler type to remove pollution caused by such gases as NO_x and SO_2 , SO_3 . Today, the world is paying attention to the fluidized-bed boiler because it can burn various types of low thermal value fuel, and because it has unique advantages in desulfation and denitration.

In addition, we should also point out that developing the fluidized-bed boiler near coal mines and mining areas to burn waste coal rock can also reduce the area for storage and resulting atmospheric pollution. When developing the fluidized-bed boiler in regions producing low thermal value fuel, the amount of smoke, ash and dust released will naturally be reduced because of the high thermal efficiency of the boiler and its conservation of fuel, i.e., conserving energy while reducing atmospheric pollution.

As centralized heating develops, the capacity of the single industrial boiler will gradually grow. The economics of using stratified combustion boilers is poor. The use of pulverized coal boilers seriously pollutes the environment, while the adaptability of the fluidized bed for fuel is broad. The economic aspect is high and it also benefits environmental protection. This point should attract the attention of concerned departments.

Fifth, our nation has a large group of people who have studied and developed the fluidized-bed boiler and its popularization and application. For over 10 years, we have already trained several thousand scientific and educational workers and several tens of thousands of frontline workers, and we have begun to organize some research enters. To push the development of fluidized-bed boilers forward, some higher educational institutions have also held short-term training classes in fluidized-bed boilers for the localities to train technical personnel in designing, operating and managing fluidized-bed boilers and to train frontline operators.

Now, China has the largest number of fluidized-bed boilers in the world. Therefore, our scientific and educational workers and frontline operators engaged in the study, popularization and use of fluidized-bed boilers can adapt to the needs in developing the fluidized-bed boiler in quantity and in quality.

But, because the fluidized-bed boiler has only a history of a dozen or so years, some problems indeed exist and urgently need to be solved:

1. It is economically irrational because of a lack of technical and economic analysis and because the supply of fuel is unstable, and some regions burn low thermal value fuel that had been transported over long distances.
2. As of now, some fluidized-bed boilers cannot produce expected results when they are designed and built because of a lack of special technical talent and scientific attitude.
3. Auxiliary equipment and facilities of some fluidized-bed boilers are not matched and are incomplete.
4. Throughout the nation, systematic experimental research work is still lacking. Large-scale work has been insufficient. Design work still cannot remove itself from empirical data.

But these problems should not be reasons limiting the popularization and use of fluidized-bed boilers. Although stratified combustion boilers and pulverized coal-fired boilers which are being commonly used today have a history of about 100 years, they still have not solved the major problem of burning waste coal rock, bone coal and inferior quality coal with a thermal output lower than 3,000 kilocalories/kilogram. The fluidized-bed boiler can be perfected only by continued exploration and improvement in popularization and use.

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CSO: 4013/169

NEW TECHNOLOGY

GREAT SUCCESS IN USING BONE COAL IN FLUIDIZED-BED BOILER ACHIEVED

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82 p 48

[Article by Zheng He [6774 0678]: "Success Realized in the Use of Bone Coal for the 35-ton/hour Fluidized-Bed Boiler To Generate Electricity"]

[Text] The Shanghai Power Generation Equipment Design Institute and the Shanghai Boiler Plant have jointly designed a 35-ton/hour fluidized-bed boiler. Built by the Shanghai Boiler Plant, it has been tested for 4 years at the Yiyang Bone Coal Power Generation and Comprehensive Utilization Experiment Plant in Hunan Province. All requirements of the 6,000-kilowatt steam turbine generator have been satisfied. It has already generated over 32,000,000 kilowatt-hours and has operated for a cumulative total of more than 6,000 hours.

The fluidized-bed boiler is a new type of boiler created by the application of fluidized-bed techniques of the chemical industry in boiler combustion. It can burn and use various types of low quality fuel which is difficult to use or cannot be used in other combustion facilities. It is also beneficial to environmental protection. Therefore, it has been widely emphasized by the world's nations. China's bone coal, waste coal rock, oil shale and such low thermal value fuel resources are very rich. Several years of research, popularization and use of fluidized-bed boilers have proven that it is technically feasible and economically rational to use fluidized-bed boilers to burn bone coal, waste coal rock and low quality coal. It is a feasible way to develop and utilize low thermal value fuel resources. Because the fluidized-bed boiler, as a new method of combustion, is still in the developmental stage, and in particular, because the fluidized-bed boiler of medium parameters burn low thermal value bone coal of below 1,000 kilocalories, there has always been a lack of successful experience in our nation and abroad.

The Yiyang Bone Coal Power Generation and Comprehensive Utilization Experiment Plant and related units made many major improvements in the boiler and its accessories during the experiment to make the generator safe and stable and to enable it to operate continuously. For example, the number of hidden pipes and heat transfer surface area were reduced, the draft velocity through the holes of the draft cap was increased, the structure of the oil ignition system was improved, and difficulties in ignition, crushing of bone coal, regulation of combustion were overcome. Relatively great breakthroughs were realized technically and economically. The cost of supplying electricity by the

experimental plant approached that of Hunan Province's own power stations with the same capacity using the single boiler and single generator with the same parameters but burning bituminous coal. In addition, the overflowing slag of the power plant was used to test produce chamotte-free cement and masonry cement and in experiments to utilize smoke ash to extract divanadium pentoxide. All indices reached the designed requirements.

Recently, the First Ministry of Machine Building commissioned the Hunan Provincial Science Committee to hold a technical evaluation meeting at the site. Attending experts unanimously believed the success of this experiment will provide a precious experience for the development and utilization of bone coal resources in our nation's southern region where coal is lacking and for the utilization of large quantities of waste coal rock in the northern coal producing regions.

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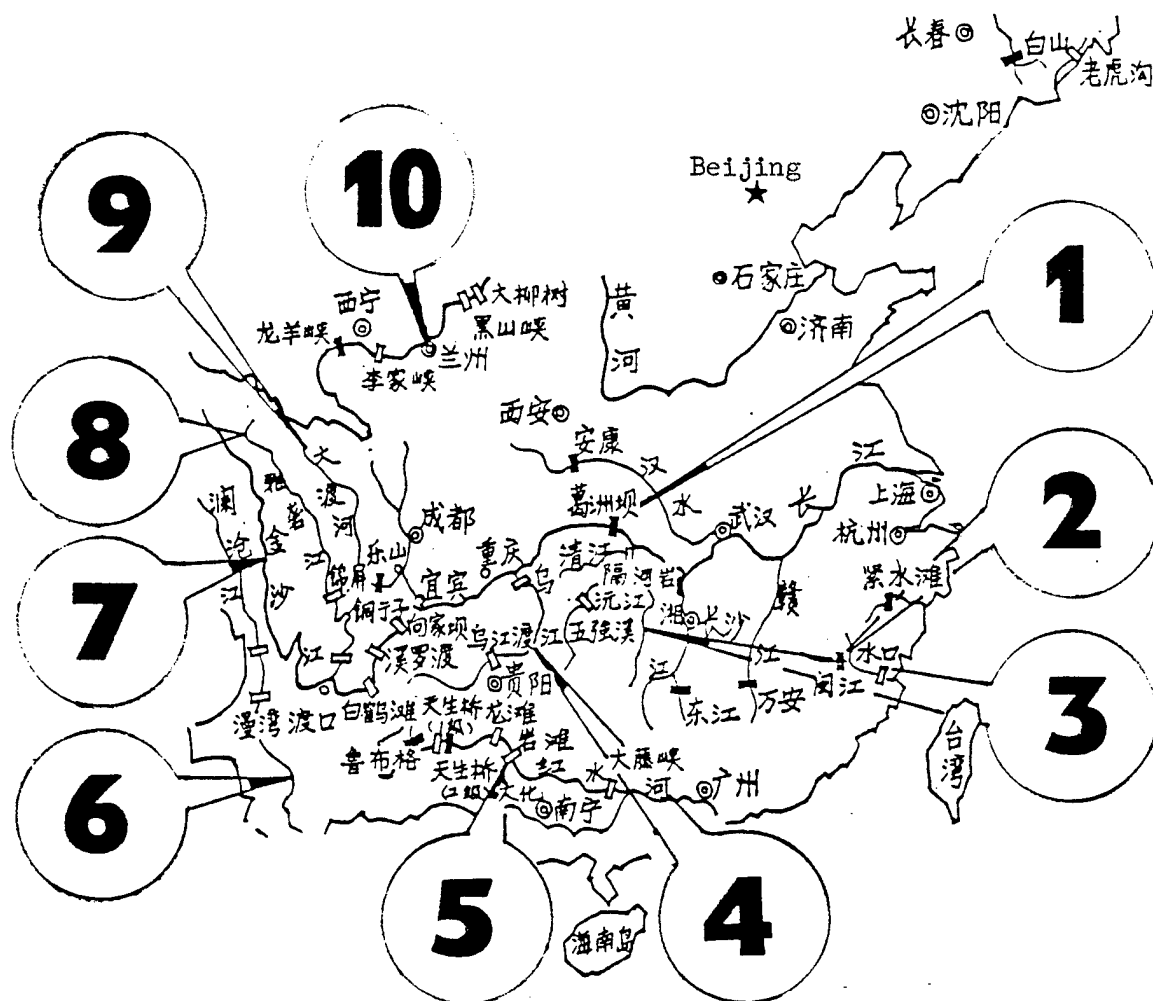
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HYDROPOWER

TEN MAJOR HYDROPOWER BASES TO BE BUILT BY END OF CENTURY

Beijing BEIJING RIBAO in Chinese 10 Nov 82 p 4

[Text] Map showing 10 major hydropower bases to be built by China by the end of this century.



[key on next page]

Key [to map]:

1. Upper reaches of the Chang Jiang Hydropower Base: Planned construction of hydropower stations with a total installed capacity of more than 30 million kilowatts. The first stage of Gezhouba, now under construction, went on stream in 1981. The enormous Sanxia [Three Gorges] hydropower station is now being surveyed, planned, and studied.
2. Min-Zhe-Gan [Fujian-Zhejiang-Jiangxi] Hydropower Base: Several dozen hydropower stations with a capacity of 25,000 kilowatts and larger could be built with a total installed capacity of 10 million kilowatts. Of the large- and medium-sized hydropower stations already built, there are the Gutian Xi cascade, Xin'an Jiang, and 15 others. Now under construction are Shaxikou, Jinshuitan, and Wan'an hydropower stations. Still to be built are the Shuikou and other large-scale hydropower stations.
3. West Hunan Hydropower Base: Within the province of Hunan, several dozen large and medium hydropower stations could be built on the Yuan Jiang, Zi Shui, and the Li Shui with a total installed capacity of more than 5 million kilowatts. The Zhexi hydropower station on the Zi Shui and the Fengtan hydropower station on the You Shui have already been built and are generating power. Under construction now is the Majitang hydropower station on the Zi Shui and construction is to begin on the Wuqiangxi large-scale hydropower station.
4. Wu Jiang Hydropower Base: The Wu Jiang is a major tributary on the upper reaches of the Chang Jiang [and the site of] planned cascade power stations with a total installed capacity of more than 5 million kilowatts. The Wujiangdu hydropower station is already generating electricity and surveying and planning work is being stepped up on other large-scale hydropower stations.
5. Hongshui He Hydropower Base: Planned are cascade power stations with a total installed capacity of more than 10 million kilowatts. Now under construction are the Tianshengqiao (2d cascade), Cahua, and other hydropower stations; the Longtan, Yantan, and Datengxia large-scale hydropower stations are to be built in succession.
6. Lancang Jiang Hydropower Base: Planned are cascade hydropower stations with a total installed capacity of more than 6 million kilowatts. The Xiaowan and Manwan hydropower stations are now in the surveying and planning stage.
7. Jinsha Jiang Hydropower Base: Planned are cascade hydropower stations with a total installed capacity of about 50 million kilowatts. The Xiangjiaba and Xiluodu hydropower stations have an installed capacity that could reach 5-10 million kilowatts, [making it] China's largest hydropower base.
8. Yalong Jiang Hydropower Base: The Yalong Jiang is the largest tributary of the Jinsha Jiang and planned are dozens of cascade hydropower stations with a total installed capacity of more than 20 million kilowatts. In addition to the Mofanggou hydropower station now completed, other large-scale hydropower stations such as Ertan are in the planning stage in an effort to begin construction at an early date.

9. Dadu He Hydropower Base: The Dadu He is the largest tributary of the Min Jiang. Planned are cascade hydropower stations with a total installed capacity of about 19 million kilowatts. Already completed is the Gongju hydropower station. Now under construction is the Tongjiezi hydropower station.

10. Huang He Upper-Middle Reaches Hydropower Base: Planned are dozens of cascade hydropower stations with a total installed capacity of 18 million kilowatts. Already completed are Liujiaxia, Yanguoxia, Bapanxia, Qingtongxia, and Sanmenxia; under construction is the Longyangxia hydropower station. To be built in succession are the Liji Xia and Heishanxia (or Daliushu) and other large-scale hydropower projects.

CSO: 4013/63

HYDROPOWER

ENERGY DEVELOPMENT: SHIFT OF EMPHASIS TO HYDROPOWER

OW101832 Beijing XINHUA in English 1528 GMT 10 Nov 82

[Text] Beijing, 10 Nov (XINHUA)--China plans to give priority to exploiting hydropower potential, Shi Jiayang, professor of hydraulic engineering of Qinghua University, told the first China-U.S. conference on energy, resources and environment here today.

The professor said that only 3 percent of China's abundant hydroelectric power resource has been developed. With long-term planning for China's economic development under contemplation, the development of hydro and thermal power with a gradual shift of emphasis to hydroelectric development must be considered, he said.

The results of China's third nationwide survey of hydroelectric potential in 1977-80 indicate that the total theoretical hydropower potential is 676 million kilowatts, corresponding to an annual energy of 5,920 billion kilowatt hours. According to the preliminary investigation and development plan, there are 11,100 water power sites each with capacity greater than 500 kilowatts, yielding an exploitable hydropower potential of 378 million kilowatts, corresponding to an annual energy output of 1,923 billion kilowatt hours, he said.

The distribution of the hydropower resources in China is quite uneven, but there is rather good coordination with the distribution of other energy resources, Shi said. For instance, in the southwest region, coal deposit constitutes only 13 percent of the national total, but the water power resource is abundant, accounting for 67.8 percent of the country's total.

By the end of 1981, China had built 90,000 hydropower stations, including the small hydropower stations, according to Shi. The total installed capacity of hydropower reached approximately 22 million kilowatts with annual output of 65.5 billion kilowatt hours. At present, China has 18 large hydroelectric plants in operation, each with capacity exceeding 250,000 kilowatts. There are also 95 medium hydroelectric plants each with a capacity of 12,000 to 250,000 kilowatts.

In the future, Professor Shi said, China will mainly tap the hydroelectric potential of large rivers such as the Chang Jiang, Huang He, Hongshui He, Jinsha Jiang, Yalong Jiang, Dadu He, Wujiang and Yarlung Zangbo, the professor said.

He said the huge Sanxia (Three Gorges) project at the upper reaches of the Chang Jiang River, which, if constructed, will be the largest hydroelectric project in China. Up to now, research and planning has been done for the project.

According to the upper dam plan, with a reservoir at the elevation of 200 meters above sea level, the storage capacity would be 73 billion cubic meters. The installed plant capacity would be 25 million kilowatts with an annual output of 110 billion kilowatt hours.

But backwater from the project would extend more than 600 kilometers upstream, causing inundation damage to 45,000 hectares of farmland and requiring the resettlement of nearly 2 million inhabitants, he said.

An alternative plan is to construct a lower dam with reservoir at an elevation 130 or 150 meters above sea level. This would greatly reduce the inundation damage and construction cost, but the installed capacity would be diminished to 7-10 million kilowatts with an annual output of 35-50 billion kilowatt hours, Shi said.

On account of the implications involving economic, social, environmental and security aspects, the final plan of this project remains to be decided, Shi Jiayang said.

CSO: 4010/21

HYDROPOWER

MIN JIANG CHOSEN AS SITE FOR HUGE NEW HYDROPOWER STATION

Fuzhou FUJIAN RIBAO in Chinese 4 Nov 82 p 4

[Excerpts] Each year, the rolling Min Jiang, that misty blue dragon, disgorges an average of 600 billion cubic meters of water into the East China Sea. Experts estimate that if hydroelectric power stations were built wherever conditions permit in the Min River Valley, tens of millions of kilowatt-hours of electricity could be generated. It has been reported that the Central Committee and the State Council have decided to build a power station at Shuikou, one of 10 big hydropower bases to be built within the next 20 years. It will be on the main stream of the Min Jiang above Minqing County. With a narrow riverbed and good geological conditions, it is an excellent site on which to build a dam. After the power station is built, a dam 100 meters high will block the Min Jiang. The power station will have an installed capacity of 1.4 million kilowatts, 5.4 times the total installed capacity of the Gutian Xi cascade power stations; 220,000-kv transmission lines will be mated to the provincial power grid while 500,000-kv power lines will feed power to Jinhua, Hangzhou, and the East China Grid. During the heavy rainfall season, several hundred million kilowatt-hours of electricity can be supplied to Shanghai, Jiangsu, and Zhejiang to meet the power needs of agricultural and industrial production. During low-water periods, thermal power from the larger grid is fed back to make up for the shortage in the province's electric energy, enhancing the benefit from combined hydro and thermal operations.

Whereas before only vessels of 70 to 80 tons were able to negotiate the river, when the project has been completed, large 500-ton ships will be able to pass through the navigation lock of the dam to reach Nanping City, increasing the yearly shipping volume 10-odd times compared to the present. Rerouted rail traffic will triple. Measures have been taken to upgrade the level of flood control for Nanping City. This large-scale hydropower station is at the top of the list of big hydropower projects for the entire East China region. In order to develop energy resources and to realize strategic goals, other large-scale hydropower projects [are planned for] the province. These include Shaxikou, Mianhuatan, and Jiemian, all with an installed capacity of more than 250,000 kilowatts and all in various stages of surveying and planning. In addition, there are about 40 medium-sized hydropower projects with an installed capacity of less than 250,000 kilowatts. In this category, Anxi, Jiangle, Zhouning, and other counties have done a lot of preliminary work on a number of medium-sized hydropower projects. Too numerous to be mentioned here are the province's small-scale hydropower projects of 25,000 kilowatts or less yet to be developed.

According to surveys, something like 1,000 stations of 500 kilowatts or more installed capacity could be built throughout the province with a total installed capacity of 7.05 billion kilowatts. Entirely developed, 32 billion kwh of power could be generated a year, or 12 times the installed capacity of hydropower projects in the province at the present time. This could replace 12 million tons of standard coal a year. If exported, this amount of coal could earn more than \$500 million in foreign exchange. Fujian's hydropower resources constitute 46 percent of those in eastern China; of the 15 provinces and municipalities in the north, northeast and east, ours is the richest.

Back in 1950, under very bleak economic conditions and with neglected tasks awaiting reconstruction, Fujian began to develop the Gutian Xi, putting the Gutian Xi cascade power stations into operation to promote economic construction in Fuzhou, Nanping, and other areas. Within a few years after the province's big hydropower stations went on stream, industrial output value grew at a rate of over 10 percent. The industrial output value grew for a variety of reasons, but it was the development of energy resources that led the way.

Fujian's rich hydropower resources are only a few hundred kilometers from the major manufacturing base of Shanghai and the important food and cotton bases of Jiangsu and Zhejiang. Conditions are excellent, and by starting the Shuikou hydroelectric project, Fujian will have a bright future indeed.

CSO: 4013/62

HYDROPOWER

HUNAN HYDROELECTRIC POWER STATION CONSTRUCTION

OW181347 Beijing XINHUA in English 1237 GMT 18 Oct 82

[Text] Changsha, 18 Oct (XINHUA)--Excavation of earth and stone for building the dam of a projected 500,000-kilowatt hydroelectric power station in Hunan Province, central China, has just been completed and work has also been started on foundation for the dam of the project.

The Dongjiang hydroelectric power station, located on the Lei Shui tributary of the Xiang Jiang, which flows into the Dongting Lake, is the biggest hydro-power project in the central China province.

Meanwhile, construction of another station, the Majitang hydroelectric power station with a designed capacity of 54,000 kilowatts, is also fully underway. Power generating equipment is being installed. One of the power generating units is expected to be put into trial operation at the end of this year.

At present, there are about 9,400 large, medium-sized and small hydroelectric power stations in the province with a total generating capacity of 1.97 million kilowatts, two of which have a generating capacity of 400,000 kilowatts, the great majority of them are small ones.

Hunan added small hydroelectric power stations with a total of 25,000 kilowatts in the first 8 months this year.

With four big river systems linking the Yangtze River, the province has a total hydroelectric power reserve of 10.8 million kilowatts. About 90 percent of the city suburbs and counties in the province have conditions for building hydro-electric power stations.

A power transmission line from Fengtan to Yiyang was also reported to be completed this May.

CSO: 4010/11

HYDROPOWER

YUNNAN HYDROELECTRIC POWER STATION BIDDING UNDERWAY

HK150121 Beijing CHINA DAILY in English 15 Oct 82 p 2

[Text] Bidding on the construction of a 600-megawatt hydroelectric power station in Yunnan Province is well underway.

Ninety pre-qualification documents have already been sold to prospective foreign contractors, an official at China Water Research and Hydropower Development Corp has revealed.

China National Technical Import Corporation (CNTIC) invited bids from foreign companies early last month. The deadline for submitting applications will fall on 6 November.

World Bank

The construction of the Lubuge hydroelectric power station, which will cost up to \$600 million, is expected to start from the fourth quarter of 1982 and be completed by 1989.

The World Bank has agreed to lend money for the project, and discussions are taking place on the exact sum to be extended.

The Kunming Designing Institute in Yunnan Province is working on details of the project with an Australian engineering corporation. A detailed bidding document will be ready in due course.

Yunnan Province is rich in mineral resources, but the shortage of electricity there poses an obstacle to their exploitation, and the growth of industry and agriculture.

Hydroelectric plants at Longyang Gorge in Qinghai Province and Gezhouba in Hubei Province are also under construction.

CSO: 4010/11

HYDROPOWER

SICHUAN'S SMALL-SCALE RURAL HYDROPOWER PROJECTS FLOURISH

Chengdu SICHUAN RIBAO in Chinese 23 Aug 82 p 1

[Article by Guo Xiangshi [6753 0686 4258]: "Fully Develop the Superiority of Hydraulic Resources Under the Guidance of the Spirit of the Third Plenum, Our Province's Small Hydroelectric Power Projects in Farm Villages Have Developed Greatly, During the Past Three Years, 1,670 Small Hydroelectric Power Stations Have Been Built With Installed Capacity of 359,000 Kilowatts"]

[Text] Under the guidance of the spirit of the party's Third Plenum, our province's small hydroelectric power projects in farm villages have developed rapidly. During the past 3 years and more, the province has built a total of 1,670 new small hydroelectric power stations with 2,375 generators installed and with a capacity of 359,000 kilowatts, equivalent to 59 percent of the total installed capacity of small hydroelectric power stations in the farm villages over the years prior to 1979. At present, the province has cumulatively built 8,258 small hydroelectric power stations in farm villages with 9,726 generators installed and a capacity of 913,000 kilowatts. They generate nearly 2.3 billion kilowatt-hours of electricity each year. All of the 195 agricultural counties (cities, wards) throughout the province have built small hydroelectric power stations. Among them, more than 20 counties have an installed capacity surpassing 10,000 kilowatts. There are over 120 counties that have small power networks consisting mainly of small hydroelectric power stations. Over one-half of the electricity consumed by agricultural and county and commune industries is supplied by small hydroelectric power stations.

In recent years, our province's small hydroelectric power stations in farm villages have grown rapidly. They have mainly developed the superiority of hydraulic resources fully, paid attention to natural laws and economic laws in carrying out the tasks, started out from the actual situation, and paid attention to practical results. Each locality has conscientiously implemented the policy of "taking the small projects as the key, allowing communes and brigades to build the projects themselves as the key, allowing the localities to manufacture the equipment as the "key," and insisted on the policy that "whoever builds a project owns the project, manages the project, and benefits from the project," and realized "using electricity to nurture electricity." Many localities provided shares and profit sharing, established joint ventures

by counties and communes, and mobilized the enthusiasm of communes and brigades to build small hydroelectric power stations.

The development of small hydroelectric power stations in farm villages provided electricity to 90 percent of the communes throughout the province. It provided a source of energy to many county towns, farms, small towns, and farm villages. It served importantly to promote the development of agriculture, local industries, commune and brigade enterprises, enlivened the farm village economy, improved the material and cultural life of the masses, increased state and local income, and reduced the pressure on large national networks to supply electricity.

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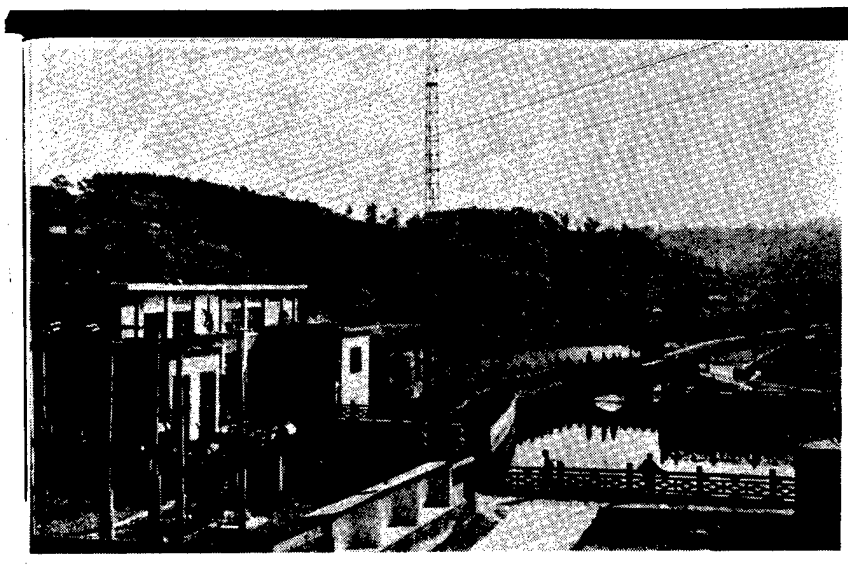
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HYDROPOWER

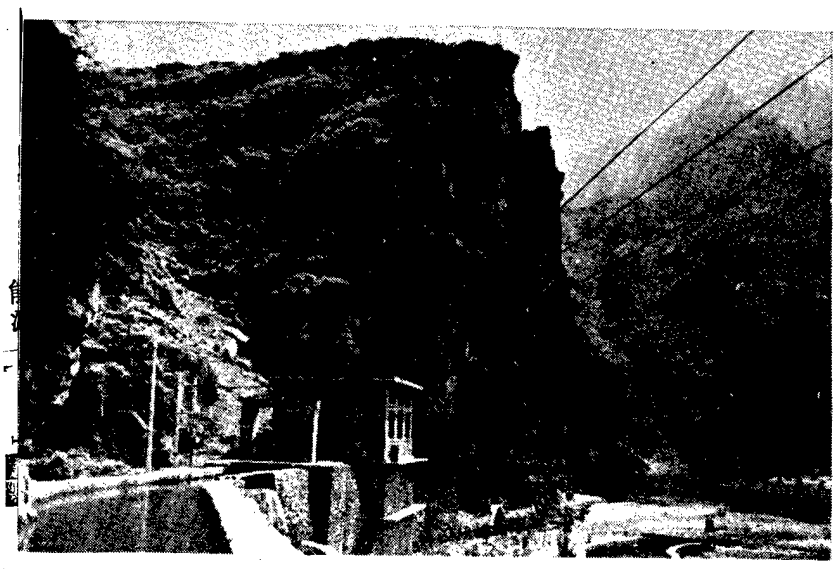
PHOTOGRAPHS DEPICT TYPICAL SMALL-SCALE HYDROPOWER STATIONS

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82 inside back cover

[Photo captions]

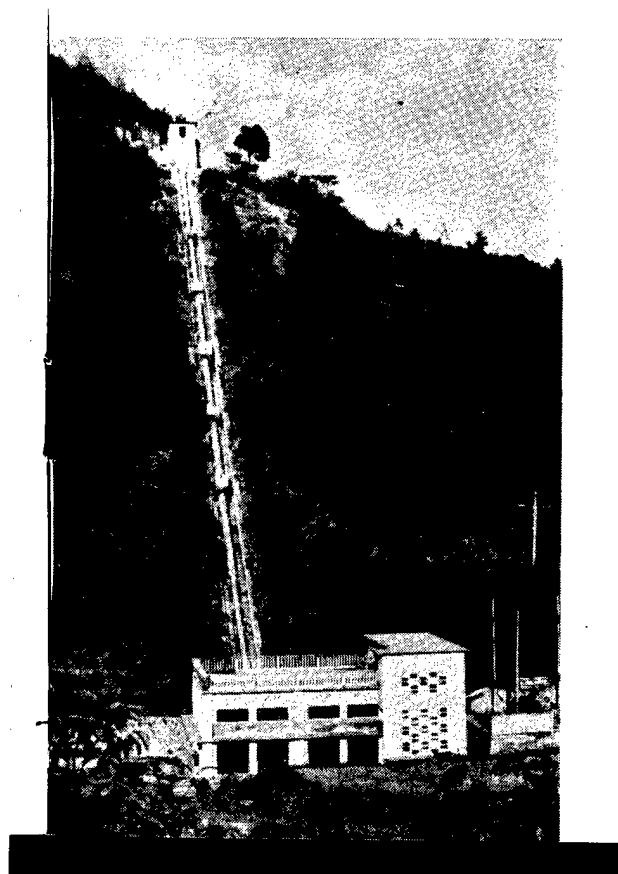


1. Yidu County, Hubei Province, fully utilized local resources and actively built small hydroelectric power stations. This is the Jintan Hydroelectric Power Station on the Yuyang He.

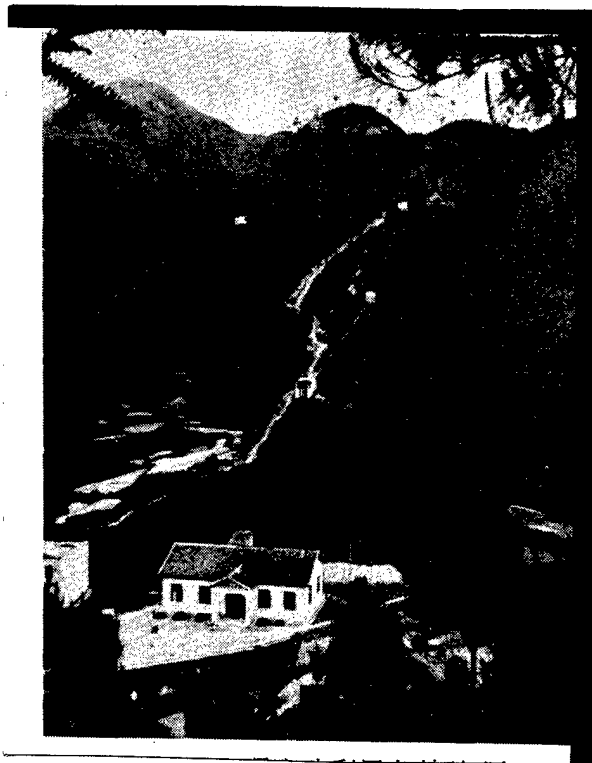


2. Xiyang Commune, Yongan County, Fujiang Province, is located in the Wuyi Mountains. It is an advanced unit in the nation in building and managing of small hydroelectricity. Photo shows a small hydroelectric power station built on the Neilu Xi.

3. Fangshan County in Beijing Municipality uses the hydraulic resources of Jumahe. In recent years, it has built over 10 small hydroelectric power stations. This is the small hydroelectric power station built by the Liudu Brigade in 1981.



4. Luchuan County in Guangxi has built over 100 small hydroelectric power stations with a total installed capacity of over 10,000 kilowatts. Photo shows a scene of the Shanmukeng Power Station of Shapo Commune in this county.



5. The ancient Dujiang Weir not only uses river water to irrigate good farmland, it also provides energy for agricultural production in the irrigated area. The Wenjiang Irrigated Area alone has built over 600 small hydroelectric power stations generating over 100 million kilowatt-hours of electricity a year. Photo shows the Qingcheng Power Station in Guanxian.

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CSO: 4013/169

HYDROPOWER

UNCOORDINATED CONSTRUCTION OF SMALL POWER STATIONS CAN CREATE CHAOS FOR PLANNERS

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82, pp 4-5, 39

[Article by Tu Hua [0960 5478]: "We Must Prevent Redundant Construction of Small Hydroelectric Power Stations"]

[Text] The question several years ago concerning redundant construction of hydroelectric power projects mainly referred to the redundant construction of large, medium and small hydroelectric power stations in the power network when such power stations joined the power network because most of the small hydroelectric power stations had poor regulatory functions, could generate electricity only during the season of abundant water, and single stations could not guarantee a supply of electricity to its users for the entire year. In letting small hydroelectric power stations generate electricity fully, large and medium hydroelectric power stations may have to lose water. In letting large and medium hydroelectric power stations generate electricity fully, small hydroelectric power stations would have to lose water. This redundant construction was very pronounced in the south where hydroelectricity constitutes a large portion of the power network. But a more serious type of redundant construction was the building of small hydroelectric power stations inside the reservoir area of large and medium hydroelectric power stations, on the dam sections, or at the dam sites, thus causing redundant construction. This article will mainly discuss ways to prevent redundant construction of the latter type.

On 6 February 1982, "People's Daily" published an urgent call: "Hurry Up and Solve the Water Conservancy Dispute in Henan and Shanxi." It was talking about a pumping station with a total capacity of 160 kilowatts jointly built by a brigade in Jincheng County in Shanxi and a production team in Xinyang County in Henan on the Dan He inside the two provinces of Shanxi and Henan. There was a plan to expand it into a small hydroelectric power station of 800 kilowatts. Henan planned to build the new Houzai Hydroelectric Power Station with an installed capacity of 3,200 kilowatts downstream from the water pumping station. After completion of that power station, the upstream water pumping station would be flooded. Before both sides reached an agreement, Henan began construction of the

station, and Shanxi also began preparing materials for construction. After completion of the Houzai Hydroelectric Power Station, the higher leading agencies mediated many times but the dispute had not been solved by the time it was printed in the paper. This is an actual case of building a redundant station on a small river without unified planning.

In the south, a small hydroelectric power station with an installed capacity of 2,130 kilowatts will be flooded by a medium hydroelectric power station now being built inside the reservoir area on a river. The locality has asked the state to appropriate 7.5 million yuan (equivalent to a compensation of about 3,520 yuan per kilowatt) from investment in the construction of this medium hydroelectric power station as compensation for the loss of this small hydroelectric power station. At the same time, the electric power department also agreed to supply electricity to that locality after completion of the medium hydroelectric power station. The locality was not satisfied with such a high compensation fund and continued to ask for an increase in compensation. It asked to move the small hydroelectric power station and rebuild it elsewhere, and asked that an additional 3.5 million yuan be appropriated to rebuild this new small hydroelectric power station so that it could supply electricity to the national power network and sell its electricity to the state after its completion. This means that the state has to compensate 11,000,000 yuan for flooding a small hydroelectric power station of 2,130 kilowatts, and for each kilowatt of electricity generated by the small hydroelectric power station flooded out, the state has to pay over 5,000 yuan. If 2 million kilowatts of the nearly 7 million kilowatts of small hydroelectric power stations throughout the nation are of this type the state will lose several billion yuan in construction capital. If we take into consideration the financial aid already given to these small hydroelectric power stations by the state during the course of their construction, the loss would be even greater. This is one case encountered by the hydroelectric power station now being constructed.

Among the large and medium power stations being planned for construction, there are also similar situations. A hydroelectric power station with a total installed capacity of 4 million kilowatts is being studied for construction on a large river in the south. The reservoir area will flood parts of two provinces. One province pointed out that construction of this large hydroelectric power station will flood six small hydroelectric power stations totalling over 10,000 kilowatts already built in the province. This does not include small hydroelectric power stations of less than 100 kilowatts. Furthermore, construction of this large hydroelectric power station will flood 1,200,000 to 2,000,000 kilowatts of hydraulic resources of medium and small rivers in the province, not including the small hydroelectric power stations to be flooded in the other province. Obviously, construction of this large hydroelectric power station will not be abandoned just for the sake of the several small hydroelectric power stations already built on the tributaries because the gain from the large hydroelectric power station will far surpass the gain from these small hydroelectric power stations. Therefore, in constructing large and medium hydroelectric power stations, if we do not

pay attention to preventing redundant construction of small hydroelectric power stations, they will bring about a major loss to the state. This is a major problem that should be noted in the development of small hydroelectric power stations.

To avoid redundant construction in hydroelectric power the key is to uniformly plan the utilization of river water resources and design and construct projects strictly according to planned requirements. How to rationally develop and utilize the hydraulic resources of a natural river is a relatively complex problem. On the same river, there can be several development plans, for example, if topographical and geological conditions allow, several high dams and large reservoirs can be built in succession to develop the hydraulic resources of the trunk river and the tributaries in a centralized way. Another plan can be to build more low waterhead hydroelectric power stations on the trunk river for scattered development and utilization, reduce the loss of flooding, the amount of work and the degree of difficulty in construction. We can also consider building dams and power stations on the many tributaries to develop small hydroelectric power and not building dams and hydroelectric power stations on the trunk rivers. Among the many plans, there must be one that can satisfy the requirements of all the sectors of the local economy, that will not cause overly large losses in flooding, and that will be economical and rational. After a plan has been selected, only the hydroelectric power stations that are included in the plan selected will be considered and hydroelectric power power stations not included in the plan will no longer exist. Small hydroelectric power stations will not be built within the area of the backwaters of reservoirs of the hydroelectric power stations of the selected plan. This is easy to understand. This principle is generally followed when building large and medium hydroelectric power stations today. Construction projects are selected on the basis of the river plans and the problem of redundant construction does not exist. But in the construction of small hydroelectric power stations, because necessary planning, designing, review and approval systems are lacking, the problem of redundant construction is more outstanding. The redundant construction of small hydroelectric power stations can generally be divided into three types:

One is the placement and building of small hydroelectric power stations inside the reservoir area of large and medium hydroelectric power stations that had already been planned. These small hydroelectric power stations will be flooded after completion of the large and medium hydroelectric power stations and this will increase the cost for compensation and evacuation of the reservoir area of the large and medium hydroelectric power stations.

The second is the placement of several small hydroelectric power stations to be built by counties and communes on river segments already slated for the building of large and medium hydroelectric power stations. For example, on a certain river segment, there is originally one medium hydroelectric power station with an installed capacity of 200,000 kilowatts. The county and commune now set up five low-waterhead runoff type

small hydroelectric power stations on the same segment, each with an installed capacity of 10,000 kilowatts, totaling 50,000 kilowatts. The former is counted and constructed as a medium hydroelectric power station while the latter are counted and constructed as small hydroelectric power stations, creating a redundancy in the count and in construction.

The third is building small hydroelectric power stations at the dam site planned for building large and medium hydroelectric power stations. This destroys the rational development of hydraulic resources, and this is redundant development and construction of hydraulic resources.

The reasons that redundant construction of small hydroelectric power stations has occurred are as follows: 1. ideologically, the damage of redundant construction is not recognized or not noted. In the construction of small hydroelectric power stations, a necessary review and approval system and regulations preventing redundant construction are lacking. Objectively speaking, there are many practical problems. First, except for the overall river plans for some large rivers and rivers with relatively rich hydraulic resources, little survey and design work has been done for many rivers, and their overall river plans have not been drawn up. The hydraulic resources of some rivers have only been generally surveyed, therefore, step development plans for many rivers have not been determined. 2. Although some rivers have been planned and river development plans have been selected, only a few leading agencies and surveying and designing units are grasping the work. But concerned counties and communes within the river valley area do not understand and it is difficult to tell whether a certain small hydroelectric power station on a certain small river would be flooded by large and medium hydroelectric power stations or not. 3. Although some counties and communes understand that certain hydroelectric power stations would be flooded in the future, for immediate benefits, they believe that even if the small power stations are flooded, the counties can always ask the state for compensation. They start out from the benefits of their own regions and still carry out construction.

The most outstanding cases of neglecting the problem of redundant construction of small hydroelectric power stations are found in the statistics on the theoretical reserves of hydraulic resources and the exploitable amount. From 1977 to 1980, China's water conservancy and hydroelectric power departments conducted a third general survey of hydraulic resources. This general survey referred to the results of hydroelectric power surveys, designs, plans and general surveys of the past 30 years and established development plans for all major rivers throughout the nation. The general survey calculated the exploitable hydraulic resources of the unit power station with an installed capacity of over 10,000 kilowatts (some provinces and regions calculated those stations with more than 500 kilowatts) throughout the nation. The total exploitable hydraulic resources throughout the nation was 378 million kilowatts with an annual output of 1,900 billion kilowatt-hour of electricity. These exploitable hydraulic resources are not redundant. But besides the statistical data of this survey, another group of statistics on small hydroelectric power resources of each province throughout the nation was

also compiled. The figure for small hydroelectric resources from September 1978 to August 1980, has been quoted as 150 million kilowatts of exploitable small hydroelectric resources. But in October 1980, the exploitable small hydroelectric resources was determined to be 70,000,000 to 75,000,000 kilowatts. According to this understanding, the exploitable small hydroelectric resources include small hydroelectric power stations inside the reservoir areas of large and medium hydroelectric power stations. This means that in the statistics on small hydroelectric resources, the seed of redundant construction has been sown.

To avoid redundant construction of small hydroelectric power stations, we must first establish clear rules regarding the method of statistical calculations for exploitable small hydroelectric resources and differentiate between redundant small hydroelectric resources and small hydroelectric resources that are not redundant. When the river plan is determined, we must mark the boundary line between the zoned reservoir area and the non-reservoir area according to development plans already selected. When the river plan has not been determined, we can temporarily use the developmental plan drawn up at the time of taking the general survey of hydraulic resources as the foundation to preliminarily mark the border between the zoned reservoir areas and the non-reservoir areas. After this border has been clarified, then all small hydroelectric power stations planned or built in the reservoir area and on the dam sites of already selected hydroelectric power stations are considered redundant small hydroelectric resources, and all small hydroelectric power stations planned and built on small rivers outside the reservoir area are non-redundant construction of small hydroelectric resources.

Non-redundant small hydroelectric resources can be developed and utilized according to the need for electricity by the locality. We must be especially careful in developing and utilizing redundant small hydroelectric resources. If large and medium hydroelectric power stations affecting small hydroelectric power stations are to be built in the near future, then those small hydroelectric power stations which will create a major loss if they are flooded in the future should not be built. If the large and medium hydroelectric power station related to that small hydroelectric power station will not be built in the near future, (or shall we say, the large power station will not be built within the effective period of use of the small hydroelectric power station), then we should allow this type of small hydroelectric power stations to be built temporarily. Because under this situation, when the large and medium hydroelectric power station is completed, that small hydroelectric power station will have completed its historical mission. The investment in the small hydroelectric power station will have been completely recovered, and it can be flooded without creating any loss to the state.

To avoid loss and waste caused by redundant construction of small hydroelectric power stations, we should grasp the following work at present:

I. We should grasp the study and analysis of hydraulic resources, strengthen river plans, and determine the rational stepped development plans for the rivers.

II. We should strengthen long-range plans for large and medium hydro-electric power stations, establish ten-year plans for hydroelectric power according to the conditions of energy resources of the locality and the need for electric power by the locality, 20-year tentative plans, and even longer tentative plans.

III. We should classify small hydroelectric resources, dividing the exploitable small hydroelectric resources into redundant resources and non-redundant resources. Redundant resources can be further divided into temporarily usable and unusable resources according to long-range and tentative plans for large and medium hydroelectric power stations.

IV. We should draw up rules and regulations that should be followed in the construction of small hydroelectric power stations. We must assign special agencies to be responsible for reviewing and approving plans, designs and construction plans for small hydroelectric power stations.

V. We should establish clear regulations regarding the evacuation and compensation for small hydroelectric power stations that are flooded. The present method of compensating small hydroelectric power stations that have been flooded far above the original value of fixed assets of small hydroelectric power stations is wrong. It will prompt localities to blindly build small hydroelectric power stations. Can we consider not compensating any small hydroelectric power station that is built without approval on dam sites of large and medium hydroelectric power stations, on river segments, and inside reservoir areas, and that are flooded after completion of the large and medium hydroelectric power station? When small hydroelectric power stations that have been approved are flooded, they should be compensated according to the net value of fixed assets of the stations (i.e., the original value of fixed assets minus depreciation over the years).

VI. We must popularize knowledge about river planning, educate cadres at each level to follow the state's unified river plans, overcome the abnormal situation of starting out only from the needs of the locality in the development of hydraulic resources, building small hydroelectric power stations at will on the dam site of large and medium projects of comprehensive utilization, dam sections and inside reservoirs, and artificially setting up obstacles and destroying the rational development and utilization of hydraulic resources.

9296

CSO: 4013/169

HYDROPOWER

BRIEFS

TIBET HYDROELECTRIC CONSTRUCTION--From its source to the southeast valley of Tibet, Yarlung Zangbo Jiang drops over 5,000 meters. There are 10 some cascades along this course, each often as much as several dozen meters. At the Great Bend in Medog County, the drop is over 2,000 meters. Because of the large volume of flow and the concentrated drops, the river has extremely rich hydraulic resources with reserves of over 110 million kw's, second only to the Chang Jiang. However, under the feudal system of the past, this rich hydropower resource could not be utilized. In addition to several state-constructed power stations, more than 500 small rural hydroelectric stations have now been constructed along the Yarlung Zangbo Jiang. Total installed capacity is now more than 54,000 kw. As a result, many Tibetan peasants and herdsmen in the mountains and valleys are now living a new life of "lifting without oil and working without oxen." (abstracted from the JIEFANG RIBAO) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

WAN'AN HYDROPOWER STATION--The large Wan'an hydroelectric station is the largest of such stations to be constructed in Jiangxi. It will have a generating capacity of 500,000 kw and an annual output of 1.935 billion kwh. When completed, the flood prevention capability in the Jian region will be greatly improved, marine transportation will also be improved, and the 300,000 mou of farmland along both banks of lower Gan Jiang will be benefited directly. (abstracted from the JIANGXI KEJIBAO [JIANGXI SCIENCE AND TECHNOLOGY]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

WUJIANGDU NO 2 GENERATOR NOW OPERATING--The No 2 generator of the Wujiangdu hydroelectric station in Guizhou has formally joined the power grid for electric power generation. Its generating capacity is 210,000 kw. This hydroelectric station is currently the largest hydroelectric project to be built in the Yanrong region. It has three generating units. The No 1 unit became operational in 1979. (abstracted from XINWEN ZHAOPIAN [NEWS PHOTOGRAPHY] of Xinhua News Agency) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

ETAN REPORTS SMOOTH OPERATION--The Etan hydroelectric station is located in Xincheng County. It was the first medium-sized power station completed on the Hongshui He. The station is equipped with a 60,000-kw. Since joining the power net for electric generation, operation has been normal. (abstracted from GUANGXI KEJIBAO [GUANGXI SCIENCE AND TECHNOLOGY]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

COMMUNE HYDROELECTRIC STATION TURNS PROFIT--The Gan Jiang hydroelectric station, developed by Magedang Commune in Lingchuan County, Shanxi, has an installed capacity of 500 kw. After joining the power net of the county hydroelectric company, it has been able to supply the power consumption of the county's 11 communes and has increased the income of the collective organization by over 30,000 yuan annually. (abstracted from SHANXI KEJIBAO [SHANXI SCIENCE AND TECHNOLOGY]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9 Sep 82 p 31] 5974

NEI MONGGOL PRAIRIE POWER STATION--The Hexigten Qi in Nei Monggol has developed a small-scale prairie hydroelectric station of over 10,000 kw. Electricity has been delivered to 16 of the 17 communes in the banner and more than half of the herdsmen's households are now using electric lighting. Small-scale hydroelectric power has promoted the development of industrial, agricultural, and animal husbandry and it has also made the life of the herdsmen easier. (abstracted from RENMING RIBAO) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9 Sep 82 p 31] 5974

MINI HYDROELECTRIC UNIT DISPLAYED--A model XJ13-L-8/2 mini hydroelectric generating unit was exhibited at the Chengdu science and technology results exchange conference in January of this year. The generator and turbine are combined as a single unit and it only requires the installation of a 40- to 50-millimeter water pipe to lead stream or spring water down from a mountain (12 meters) to generate 250 watts of 220-volt alternating current. It can supply the lighting or household electric appliances of two to four families. Its water consumption is small (0.29 cubic meters per minute) and it can satisfy the needs of the scattered households in the mountain regions. It may play an important part in the full utilization of hydraulic resources, conservation of other energy resources, popularization of broadcasting and television, and improvement of the material and cultural well being of the people. (abstracted from DIANZIBAO [ELECTRICAL NEWS]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9 Sep 82 p 31] 5974

CSO: 4013/36

THERMAL POWER

CHINA BUILDS MORE PIT MOUTH ELECTRIC POWER PLANTS

Beijing GONGREN RIBAO in Chinese 28 Aug 82 p 1

[Text] In order to make use of local coal resources, increase economic gain, and reduce the burden on railroads, China's electric power sector has, since 1979, been building more large-scale pit mouth electric power plants in Shaanxi, Henan, Jiangsu, Shandong, Shanxi, and Hebei. Generators with a total installed capacity of 3,175,000 kilowatts are now operational and generating power.

With power plants built near mines in rich coal deposits, full use can be made of local coal resources, both power and fuel supply can be guaranteed, the pressure on the railroads can be eased, and the cost of generating power can be lowered. Smoke that pollutes the environment of urban areas is reduced as well. It is a new way for the state to develop energy resources. The Dou He Power Plant in the Tangshan mining region of Hebei is the largest pit mouth plant now under construction and already generates 750,000 kilowatts; four additional Chinese-made 200,000-kw generators will be installed for a total capacity of 1,550 mw. The "Liang Huai" coal base of Anhui is also building and expanding a number of large-scale pit mouth power plants and has already put into operation generators with a total capacity of 1,150,000 kilowatts. After three power plants now under construction are completed, the total installed electricity generating capacity will be more than 3 million kilowatts, making it the largest thermal power center in the East China Grid.

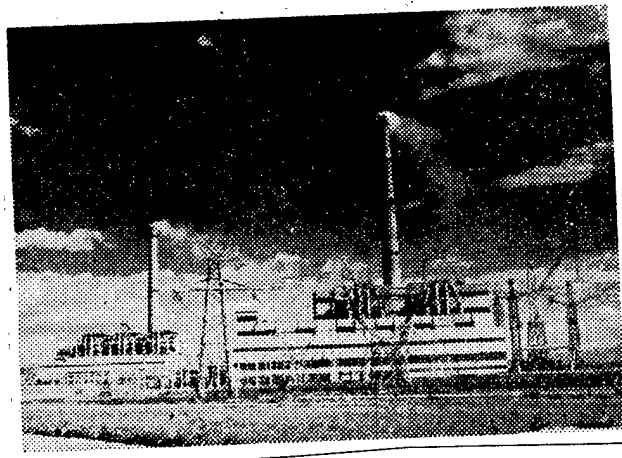
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THERMAL POWER

SHENTOU PIT-MOUTH PROJECT IS LARGEST THERMAL POWER PLANT IN SHANXI

Beijing GUANGMING RIBAO in Chinese 3 Nov 82 p 1

[Text] The Shentou Power Plant in Shanxi is one of the nation's large-scale pit-mouth power plants. Under construction for 8 years, the installed capacity is 550,000 kilowatts, making it the largest thermal power plant in Shanxi Province. The third-stage expansion project is now in full swing and after completion will constitute one of China's large-scale power plants of more than 1 million kilowatts [installed capacity]. Its powerful current will be fed into the first 500,000-volt ultrahigh-tension power line now under construction for the Beijing-Tianjin-Tangshan area.



Construction has been accelerated on the Shentou Thermal power plant.

CSO: 4013/56

THERMAL POWER

GUANGDONG TO BUILD GIANT THERMAL POWER PLANT AT SHAJIAO

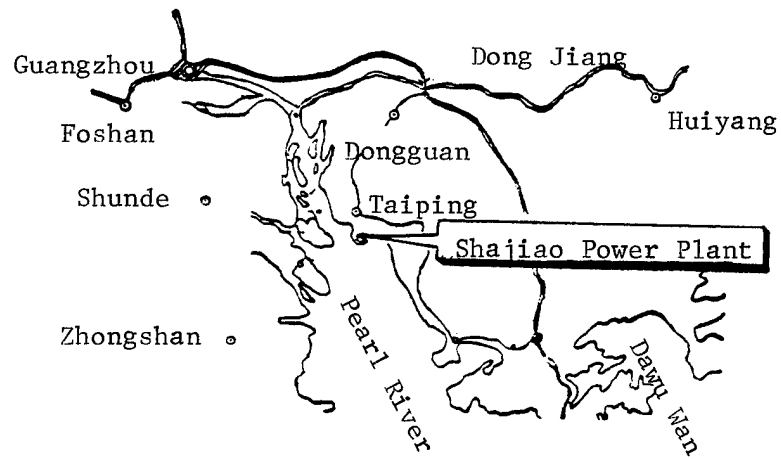
Guangzhou YANGCHENG WANBAO in Chinese 19 Oct 82 p 1

[Text] In order to improve Guangdong's electric power supply, the State Council has approved the construction of a large-scale thermal power plant in the province, the Shajiao Power Plant. After construction, the power plant will have an installed capacity of 1,200,000 kilowatts, the largest power plant in the province to date. For the Shajiao Power Plant site selection, an area on the coast of the Pearl River Estuary south of Shajiao, Qishan, and Baiheshan in Humen Commune, Dongguan County was chosen. Taipingzhen in Dongguan County is 11 kilometers to the north, Tanquan City is 60 kilometers to the east and Fanyu is just across the river. It is about 105 kilometers from Guangzhou City. Its geographical location is advantageous and water and land access is convenient.

The Shajiao Power Plant is a two-stage project, with the first stage consisting of the installation of 600,000 kilowatts (three 200,000-kilowatt steam turbine generators). The coal will be shipped from Shanxi Province by rail to Qinhuangdao or Lianyungang where it will be loaded aboard ships. From there, 10,000-ton vessels will bring it to a special pier at the Shajiao Power Plant.

According to the plans, Shajiao Power Plant's No 1 steam turbine generator will go on stream in 1986. Following completion of the first-stage construction, yearly power output could exceed 4 billion kwh, or a 50 percent increase in the current amount of power in the Guangdong power grid. When the time comes, Guangzhou, Tanquan, Foshan, Jiangmen, and other power consumers will witness a dramatic improvement.

Today, the Shajiao Power Plant construction headquarters has been set up, and over one hundred advance personnel are on the site preparing to break ground. It has been reported that this construction project is the largest and most expensive one of its kind undertaken in Guangdong since Liberation.



CSO: 4013/40

THERMAL POWER

HUAIBEI, HUAINAN MINING REGIONS TO BUILD, EXPAND THERMAL POWER PLANTS

Beijing RENMIN RIBAO in Chinese 13 Aug 82, p 1

[Article: "Huaibei, Huainan Mining Regions To Build and Expand Three Power Plants; They Will Become the Largest Thermal Electric Power Centers in Eastern China"]

[Text] NCNA reporter Tian Xuexiang [3944 1331 4382] reports: The Huainan and Huaibei mining regions, which produce a lot of coal in Anhui Province, are building and expanding a group of thermal power plants. After completion of these plants, the Huainan and Huaibei mining regions will become the largest thermal electric power center in eastern China.

The power plants in the Huainan and Huaibei mining regions now have a total installed capacity of 1,151,000 kilowatts. At present, three large power plants are being constructed with a total installed capacity of 2 million kilowatts. Among them, the Huaibei Power Plant is being enlarged by installing an additional 200,000-kilowatt generator. It will begin production within this year. The first phase construction of the new Lehe Power Plant will install two 300,000-kilowatts generators. At present, construction is being intensified. The first phase construction of the new Pingyu Power Plant plans to install two 600,000-kilowatt generators. Preparatory work has generally been completed and construction will begin soon.

9296

CSO: 4013/161

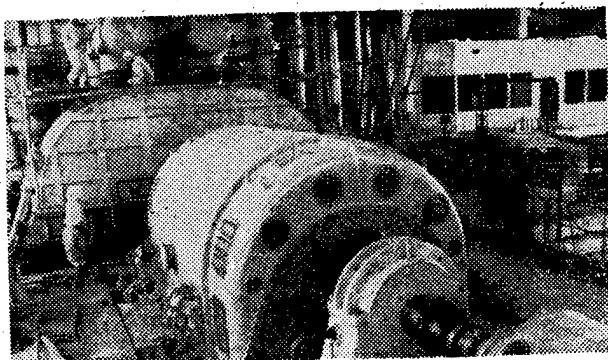
THERMAL POWER

WORKERS HOPE TO HAVE TAIZHOU PLANT GENERATING POWER BEFORE END OF 1982

Hangzhou ZHEJIANG RIBAO in Chinese 1 Nov 82 p 2

[Text] The 500,000 kw Taizhou Power Plant now under construction is one of the most important projects in the nation at present. Its construction and power generation will greatly improve the power use situation in Taizhou, Wenzhou and Lishui, creating a great boost for industrial and agricultural production.

Today, construction personnel, inspired by the spirit of the 12th Party Congress, are painstakingly organizing and rationally managing things to accelerate construction and installation in an effort to have the No 1 generator (125,000 kw) operational before the end of the year--2 months ahead of schedule.



Recent photograph showing the No 1 generator, now installed.

CSO: 4013/66

THERMAL POWER

BRIEFS

ANHUI THERMAL POWER CENTER--Hefei, 12 Aug (XINHUA)--Construction is underway on a large thermal electric power plant at the Anhui coal center on both banks of the Huai He. As part of the effort to one day turn this major coal producer into the biggest thermal power center in East China. Two electric power generating units--each with a designed capacity of 300,000 kilowatts--are being installed at the Luche Thermal Power Plant, now in the first stage of construction, according to provincial authorities. Preparatory work has been completed on the construction of the Pingyu Power Plant, which is scheduled to begin soon. Two 600,000 kilowatt-power generating units will be installed during the first stage of construction. The Anhui coal center is the largest in the area south of China's Huanghe River, where eight new mines with a combined annual production capacity of 15 million tons are to be opened for production between 1981 and 1988. [Beijing XINHUA in English 1254 GMT 12 Aug 82 OW]

QINLING THERMAL POWER PLANT--Xian, 26 Sep (XINHUA)--The second-stage work of the construction of Shaanxi's Qinling Thermal Power Plant is in rapid progress. Now the No 1 generating unit with a 200,000 kw capacity has been installed and put into operation. Another generating unit with the same capacity will also be installed during the second stage of construction. The first-stage work, which has already been completed, has a generating capacity of 250,000 kw. This thermal power plant, located in Huayin County, is the largest of its kind in northeastern China. Coal for this power plant is supplied from the Weibei coalfield. (Text) [Beijing XINHUA Domestic Service in Chinese 0039 GMT 26 Sep 82 OW]

SHANXI POWER PLANT--The Niangziguan Power Plant in Shanxi has put into operation its No 4 generating unit with a capacity of 100,000 kw. The operation of this generating unit has brought the plant's total capacity to 400,000 kw. This thermal power plant, which exploits locally available coal for power generation, will play a significant role in easing the shortage of power supply in northern China and in electrification of the Shijiazhuang-Triyuan Railway. [Text] [Beijing in Mandarin to Taiwan 1500 GMT 5 Oct 82 OW]

DAWUKOU PIT-MOUTH POWER PLANT--Ground was recently broken and construction begun on the Dawukou Power Plant, the first such large-scale project in the Ningxia Huizu Autonomous Region. The Dawukou Power Plant project will have four 100,000-kilowatt generators with a total installed capacity of 400,000 kilowatts. Yearly power output can reach 2 billion kwh and more. The electric power thus generated will be transmitted via high-tension power lines into the Shanxi-Gansu-Qinghai grid, meeting the region's power needs, and also supply power to the Yulin area of Shaanxi and to the western areas of Nei Monggol. After the Dawukou Power Plant becomes operational, a portion of the coal in Ningxia can be used to generate power locally, greatly reducing the burden on the railroads. [Text] [Taiyuan SHANXI RIBAO in Chinese 16 Oct 82 p 4]

CSO: 4013/56

COAL

COAL MINISTER NOTES 1.2 BILLION-TON OUTPUT TARGET BY YEAR 2000

HK060346 Beijing CHINA DAILY in English 6 Nov 82 p 2

[Article by Xu Yuanchao]

[Text] China's target for coal production by the end of this century is more than 1.2 billion tons a year, according to Gao Yangwen, minister of coal industry.

He disclosed this in an interview with George Nelson, president of the Sino-British Trade Council and chairman of the General Electric Company PLC.

This target is based on the assumption that there will also be energy-saving efforts. Coal output has climbed to the current 630 million tons from 30 million tons 33 years ago.

To increase annual production by 600 million tons in the next 18 years, 250 large coal mines must be modernized, he said.

China is rich in coal reserves and is undertaking coal exploitation on a large scale.

Mines under construction have 100 million tons of reserves. In addition, China will continue to develop opencast mines, raising their annual output eventually to 200 million tons from the current 20 million tons, Gao said.

Meanwhile, the government will adopt measures to encourage small local mines, leaving most of their production for local consumption, he said.

Every year, the central government allocates money to the coal industry. In addition, investment will come from local governments.

China is still plagued with a shortage of funds.

"We will absorb more funds from abroad and attract more foreign businessmen to invest in China," he said. "Mines using foreign funds now produce an average of 30 million tons of coal a year."

With development of the coal industry, China will expand contacts with foreign countries and absorb more funds in the form of joint ventures and compensation trade, he added.

China and a U.S. firm, Occidental Petroleum, are near agreement on joint development of a large coal mine.

The project--the Antaibao Coal Mine, part of the vast Pingshuo coal field in Shanxi Province--is believed to be the largest joint venture between China and a foreign concern.

The China Coal Development Corporation has also signed a draft agreement with British Shell Coal International for a feasibility study at the Jining No 2 Coal Mine in Shandong Province, east China.

Referring to competition in the world coal market, Gao said: "China has never sought to be a coal exporter.

"We produce coal just for domestic consumption, although small quantities should be exported to compensate for foreign investment and long-term trade agreements with some countries."

Coal trade in the world market totals about 250 million tons a year, about seven million tons of it from China.

Discussing cooperation in developing southwest China's energy, Gao noted that China had imported mining equipment worth \$250 million from Britain during the 1970's.

It was mainly hydraulic supports and heading machines.

In the next 18 years, China will import complete sets of equipment and will make other mining equipment in cooperation with British firms.

Cooperation in developing southwest China's energy will be in two steps, he said.

On the one hand, existing mines and ports will be improved. On the other hand, a new railway, a coal mine and a power station will be built and two ports will be expanded.

At the same time, a gasification plant is planned for Yunnan Province.

Gao also discussed with Nelson the possibility of sending to China a survey team of experts in coal mining, railways and ports later this year.

Nelson and his 12-member mission arrived in Beijing last Sunday and leave for home on November 14. The mission will visit Xian, Tianjin and Dalian.

CSO: 4010/22

COAL

NATION'S COAL PROCESSING, UTILIZATION THROUGH YEAR 2000 OUTLINED

OW302106 Beijing XINHUA in English 1512 GMT 29 Oct 82

[Text] Beijing, 29 October (XINHUA)--Coal gasification, liquefaction and coking and coal chemical extraction are the main products of China's coal processing and multi-purpose utilization in the remaining years of this century.

This statement was made by Hao Fengyin, director of the Coal Processing and Utilization Bureau under the Ministry of Coal Industry, in addressing the inauguration of the China Coal Processing and Utilization Association set up here today. The association, composed of coal producers as well as consumers, is committed to help stimulate this field of work in the interest of overall national economic growth.

According to the director, plans were mapped out to make coal processing and utilization suitable for doubling China's annual coal output of 600 million tons by the end of the century. These include:

--Mechanized coal washing and processing, improved quality and increased variety of products to use coal to the best advantage.

--Broaden the scope of business by developing multi-purpose utilization with coal by-products as the chief material. More coal refuse and gangue will be used to make chemicals of coal and building materials. Mining areas are encouraged to produce more molded coal for home and industrial consumption and to build power plants fueled by coal of low calorie value at hand.

--Upgrade techniques for coal processing, rationalize utilization and revamp existing processing plants.

--Carry out feasibility studies of coal gasification, liquefaction, coking and coal chemical extraction in the decade to come.

At present, Hao Fengyin said, coal gasification experiments are being carried out in Shenyang, a heavy industrial city in northeast China, China's leading coal producer of Taiyuan in Shanxi Province and Yantai in Shandong Province.

China is the world's third largest coal producer, at 620 million tons annually. There are now 110 coal washing plants in the country, with a total annual dressing capacity of 110 million tons. Though mechanized coal dressing was introduced in recent years, the capacity is still not commensurate with the gross national output.

By the end of 1981, the director said, China's coal departments had converted 530 old boilers into fluidized-bed boilers fueled by coal refuse, registering a total steam capacity of 3,550 tons. A number of power plants fueled by low calorie value coal have gone into operation. The power plant at Yongrong mining administration in Sichuan Province reduced costs by 40 percent while increasing output by 200 percent after converting all its boilers into fluidized-bed boilers.

Meanwhile, the coal departments had set up 481 kilns and cement plants using gangue, bone coal and coal refuse as raw materials, producing 1,500 million bricks and tiles and more than 500,000 tons of cement each year.

Recent years have witnessed improvements in quality and continuous decreases in cost of such coal chemicals as moutan wax, aluminum chloride, aluminum polymere, and vanadium pentoxide. Vanadium pentoxide has already found its way into the world market.

CSO: 4010/16

COAL

MULTIPLE UTILIZATION, COMPREHENSIVE MANAGEMENT OF COAL INDUSTRY DISCUSSED

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82 pp 12, 43

[Article by the Policy Research Office of the Ministry of Coal Industry: "On Comprehensive Management of Our Nation's Coal Industry and Comprehensive Utilization"]

[Text] Coal is our nation's main source of energy. Annual output is 620 million tons, constituting 70 percent of the energy structure of the whole nation. How to utilize our nation's coal resources directly affects our nation's buildup of the four modernizations and people's lives. In the past, the coal departments cared only about production and marketing of raw coal. The ability to dress and process coal was weak, comprehensive utilization was weak, the combustion method was backward, thermal efficiency was low, wastefulness was serious, and the environment was polluted. On the other hand, because of singular management, many coal mines suffered losses. These situations affect the expansion of reproduction in the coal industry to a certain degree and the improvement of the life of the workers in mining regions, and they are very unfavorable to the development of the coal industry.

To hasten the rate of development of the coal industry, to fully utilize coal resources, conserve energy and change singular management to diversified management, the development of comprehensive utilization of coal must be carried out. This means, the work of the coal departments does not just involve mining, transportation and marketing, but also processing and utilization. This is an important policy that must be followed in developing the coal industry.

According to surveys, the potential to develop comprehensive management and comprehensive utilization of our nation's coal industry is very great. Our nation produces over 600 million tons of coal each year. Over 100 million tons are washed and processed. If we take out another 200 million tons for washing and processing, increase varieties, supply market needs, we will be able to increase the production value by 2.5 billion yuan with a profit of 800 million yuan. The amount of waste coal rock accumulated over the years at the coal mines uniformly equipped by the state amounts to 1 billion tons. Each year, 70,000,000 tons of waste rock are newly added. If combustible waste rocks with a higher thermal value are used, each 10,000,000 tons of waste rock can approximately replace 1,500,000 to 2,000,000 tons of superior quality coal. If the coal mines utilize waste coal rock to fire bricks, manufacture cement

and become self sufficient, each year, over 400 million yuan of wealth can be created and a profit of over 40,000,000 yuan can be realized. The future of using the gas in coal mines, gasification of coal, coal chemistry, etc. is broad. The development of comprehensive management of the coal industry and comprehensive utilization will improve the economic gain of our nation's coal industry and promote the development of the coal industry.

The processing and utilization of coal involve many subjects. They are mainly the following:

(1) Preliminary Processing. Preliminary processing of coal involves the following: Washing and selection of coal, classification of coal, supplying the right variety of coal, processing pulverized coal into molded coal, rationally supplying coal to users according to need. Washing, selecting and processing coal well will improve thermal efficiency and conserve coal. For example, by coking coal concentrates, the ash content can be reduced 1 percent and this can conserve 2.66 percent of coal. Each year, the nation can conserve over 1,300,000 tons of coal concentrates. If the steam locomotive burns molded coal, we can conserve about 15 percent of coal, and in a year, we can save 4 million tons of coal. If we make pulverized coal of poor quality for civilian use into molded coal, we can conserve about 15 percent of coal.

(2) The Utilization of Coal Gas. Our nation has an abundance of gas resources in the coal mines. At present, the annual amount extracted is about 310 million cubic meters. Calculating at 9,000 kilocalories of heat generated per cubic meter, this is equivalent to 400,000 tons of standard coal. Gasification of coal includes gasification in factories, gasification in various coal gas furnaces and underground gasification. These can improve thermal efficiency and also reduce pollution.

(3) Liquefaction of Coal. From the long term view, it can replace petroleum. Of course, the main task at present is to carry out scientific research and experimental work.

(4) Coal Chemistry. Chemical products extracted from coal and gas can be supplied to the light industry sector.

(5) Using Inferior Quality Coal in Mining Regions To Generate Electricity. Inferior quality coal used to generate electricity can replace superior quality coal and conserve power and it can also provide electric power to society.

(6) The Utilization of Kerogen Shale. The known reserve of kerogen shale in China is over 30 billion tons. If this part of the resources is utilized as a low thermal value fuel, waste can become treasures and chemical products can be extracted from it.

(7) The Utilization of Sideline Products of Coal Mines and By-products From Burning Coal. These include such things as waste rock, coal cinder, and smoke dust for manufacturing building materials.

(8) Utilization of Paragenic Minerals. Some coal fields not only have reserves of coal resources, they also have other associated and paragenic mineral resources, such as alum, ferric sulfide, clay, gypsum. If they can be uniformly mined, we can save money and labor, and create new wealth.

(9) The Study and Improvement of Counties Burning Coal Stoves. We can develop all types of stoves, from the simple cook stove, water boiling stove to heating aluminum stoves and electricity generating aluminum stoves. The common dual purpose household stove can be rebuilt and this can save 15 percent of coal. If a city uses 4 million tons of coal, then after improving the stoves, over 600,000 tons of coal can be conserved.

To improve comprehensive management of the coal industry, processing and utilization, there are the following suggestions:

First, we must start out from the actual situation in China to develop coal processing and utilization, carry out the projects that require less money and that are easy to do. Projects that pose great difficulties can be taken as scientific research subjects. We should progress from the easy to the difficult, from the small to the large, and develop gradually. By processing coal, we can change low quality coal into high quality coal, change a single product into many kinds of products, change singular management into comprehensive management so as to obtain the best economic benefit for the coal industry and the best results in energy conservation.

To improve people's understanding of comprehensive utilization of coal, we must first create public opinion, carry out propaganda broadly, let comprehensive utilization by the coal industry and the policy of comprehensive management determined by the central authorities take root, and make this work a task for all coal workers and the whole society. Only in this way can a new situation emerge in the processing and utilization of coal.

Second, we must grasp experimental work at certain sites, conscientiously summarize and popularize their experience. For this, we can establish technology popularization stations and guiding groups, train specialized personnel and gradually carry out the work.

Third, we should strengthen scientific research in the processing and utilization of coal, we should include key scientific research projects in the plans, organize forces to do the work so that scientific research can lead and so that scientific research can better serve production.

Fourth, we should organize social forces, including production, use, scientific research, education, materials and commerce to develop the processing and utilization of coal.

Fifth, we should study and establish some economic policies to help coal processing and comprehensive utilization and to mobilize enthusiasm so that coal processing and utilization can develop prosperously towards creating a relatively big change within 3 to 5 years.

COAL

COAL MINES TO BE UPGRADED WITH IMPORTED EQUIPMENT

OW091233 Beijing XINHUA in English 1210 GMT 9 Nov 82

[Text] Nanjing, November 9 (XINHUA)--A nine-member delegation from Xuzhou, a major east China coal center, will soon leave for the United States and the Federal Republic of Germany to buy winches, pumps, safety control and other mining facilities worth a total of seven million U.S. dollars.

The Xuzhou Mining Administration in Jiangsu Province is executing a compensation trade contract under which the Lotus Corporation of the United States will provide loans of 35.6 million U.S. dollars to renovate one of the administration's 13 mines, provincial authorities said. Through renovation, the Zhangji Mine is expected to increase its annual output from 450,000 tons at present to 1.2 million tons in five years.

The loans--capital plus interest--will be paid back in seven years, provincial authorities said, with 1.35 million tons of coal.

Xuzhou produces more than 10 million tons of coal a year and its coal reserves are verified at no less than 2,000 million tons. Since 1975, according to provincial authorities, the administration has imported 17 sets of hydraulic supports from West Germany and other countries, and eight tunnelling machines from Japan and Austria.

Energy production is one of the strategic priorities in China's modernization endeavour. Central authorities last week announced a decision to call an international investment meeting at the end of 1982 or in early 1983 to solicit more funds for the country's coal industry.

CSO: 4010/22

COAL

FOREIGN FUNDS BOOST SHANDONG COAL INDUSTRY

OW020919 Beijing XINHUA in English 1634 GMT 30 Oct 82

[Text] Beijing, 30 October (XINHUA)--Shandong Province, already one of China's major coal producers, has announced plans to start 46 new mines between now and the year 2000 in order to increase its annual coal output to 80 million tons. It expects to produce 42 million tons in 1982.

Four new mines are now being opened with foreign funds, officials of the Shandong Provincial Coal Industry Bureau told XINHUA today. Some of the equipment for these mines will come from the United States, Japan and France.

At present, foreign capital and technology are used to build coal mines with a combined annual production capacity of 11.5 million tons.

Shandong officials are about to leave Beijing following a 5-day national meeting on coal imports and exports which closed yesterday. It was decided at the meeting that an international investment meeting would be held before the end of 1982 or in early 1983. Mines being constructed with foreign funds across China are expected to produce an annual average of 34 million tons, it was disclosed at the meeting.

Coal reserves in Shandong Province are verified at 16,400 million tons.

CSO: 4010/16

COAL

WAYS TO DEVELOP COAL LIQUEFACTION IN CHINA SUGGESTED

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese, No 4, 25 Aug 82 p 36

[Article by Zhang Zaihao [1728 0961 3185]]

[Text] Coal liquefaction now has a history of 70 years. In recent years, because of the dramatic rise in the price of petroleum, a second golden era of coal has come about. Therefore, coal liquefaction has again been emphasized by all nations. The United States, South Africa, West Germany, Japan, Britain, Canada, the Soviet Union, Australia, and Poland are all actively developing such research. The purpose is to find a substitute for expensive petroleum.

Our nation's research in coal liquefaction is at the beginning stage. The primary task at present is to establish a long range plan and some concrete policies that suit the actual situation based on our nation's concrete situation. For this, the following views are presented regarding the development of our nation's coal liquefaction:

I. As the national economy develops, we should gradually increase the investment in the techniques of coal liquefaction. Our nation has abundant coal resources. The future in developing petroleum is also bright. For a relatively long time, coal will still be the main source in our nation's energy production and consumption structure. The proportion of coal will be about 70 percent. Of course, using coal as the main source is not mainly the direct burning of coal. Directly burning coal can be said to produce no benefits except its thermal efficiency as a one-time energy source, and this still requires further exploration. For example, everyone knows about the inconvenience in storing, transporting and using coal. The problems brought about by coal in environmental protection are serious. In our nation, the amount of dust falling on every square kilometer each month according to regulations should be less than 6 to 8 tons. But, the actual amount of dust falling in the several large cities in our nation's northern region is much higher. The amounts of sulphur dioxide and nitrogen and oxygen compounds released have greatly surpassed the standards stipulated by the state. In the developmental viewpoint, even power stations that burn coal will not remain at directly burning coal for a long period. The United States is testing solvent refining, i.e., coal and a solvent are mixed to become coal paste. This is dissolved and liquefied by hydrogenation under high pressure and high temperature to produce low ash and low sulfur

solid fuel for firing by power plants. Our nation relies mainly on coal. It is entirely necessary to place emphasis on the problem of coal processing and utilization including coal liquefaction.

II. In guiding ideology, emphasis should be on technical preparations to hasten basic research, select technology, test various types of coal, train people.

III. We should not rush things and we should not be influenced by some nations which have hastened the progress in coal liquefaction based on their own specific national situation and thus be anxious to realize achievements by proposing overly high demands.

IV. In scale, our projects should not be too large. At least within this century, we should plan various tasks by taking the establishment of medium test plants as the goal. After realizing success in medium test plants, we still should determine whether the medium test plants should be enlarged to the scale of an industry according to the situation at that time.

V. In method, we should pursue international cooperation to fully utilize advanced technology and capital of foreign nations.

VI. We should develop feasibility studies. The studies can include: long-range prospects of energy supply and demand, the proportion of coal liquefaction products in future energy structure and market demands, the economic nature and the competitive ability of liquefied coal products, the direction of scientific research, the technological line, the conditions to develop liquefaction, such as the distribution of the reserves, hydrogeology, transportation, industrial distribution, site selection, etc.

9296

CSO: 4013/169

COAL

CHINA TO INTENSIFY GEOLOGICAL SURVEYS FOR COAL

OW221229 Beijing XINHUA Domestic Service in Chinese 0055 GMT 20 Oct 82

[Text] Beijing, 20 Oct (XINHUA)--In accordance with the great objective set by the 12th CPC National Congress, the Ministry of Geology and Minerals has decided to make geological surveys for new coalfields the work focus for the next 10 years so as to make available enough energy resources for our economic development in the last decade of this century. This decision was made at a national work conference on coalfield geological survey held recently in Beijing.

The major energy source in China, coal accounts for over 70 percent of the present energy supply and is one of the important factors on which our national economic development hinges. Since we must quadruple the gross annual value of industrial and agricultural production in our country by the end of this century, there must be a correspondingly large increase in the output of coal, the major source of energy. China now has 640 billion dun of proven coal reserves. Of this total, only some 70 billion dun are carefully prospected reserves which can be, but have not yet been, mined. Because of technical, transport and other reasons, about half the carefully prospected proven reserves cannot be exploited in the near future or for a long while. Added to this is the problem of the low percentage of extraction, and hence the low rate of exploitation, of these reserves. Accordingly, there is a shortage of reserved resources for the purpose of formulating a coal industry development plan for the last decade of this century. Intensifying geological surveys for new coalfields has thus become an urgent task.

To meet the needs of developing the coal industry, the Ministry of Geology and Minerals has promptly adjusted its work plan by placing emphasis on geological surveys for new coalfields. The main tasks for the next 10 years have been set out as follows:

1. Surveys for coal reserves should be completed by 1990 in all parts of the country, except parts of Xinjiang, Nei Monggol and Xizang. Data collected should be submitted to the authorities concerned to be used as a scientific basis for drawing up a long-term coal industry development plan and for mapping out a rational distribution of the mining areas.
2. The focus of geological surveys for coalfields will be on Shandong, Henan, Anhui, Shanxi, Nei Monggol, Heilongjiang, Jilin, Ningxia, Yunnan, Guizhou

and Sichuan. The purpose is to provide favorable conditions for coalfield prospecting work during the seventh 5-year plan period and the last decade of this century.

3. Detailed prospecting will be conducted in the large and medium-sized mining areas, which are listed in the national construction and development program, in the hope that considerable proven coal reserves will be found to meet the needs of the development of the coal industry in the near future and further ahead.

The Ministry of Geology and Minerals urges the geological departments in coal-rich areas to uphold the concept of overall and long-term interests and speed up surveys to find more and better coal reserves to support the areas of coal shortage. As for those areas, where geological conditions exist, the geological departments concerned should persist in coalfield geological surveys to find more coal resources if at all possible. The Ministry of Geology and Minerals also requests that geology and mineral departments and coal industry departments at all levels form close ties, coordinate with each other and provide mutual information and material in an effort to create a new situation in the work of geological surveys for coalfields.

CSO: 4013/24

COAL

DATUN COAL DRESSING PLANT COMPLETED, RUNNING SMOOTHLY

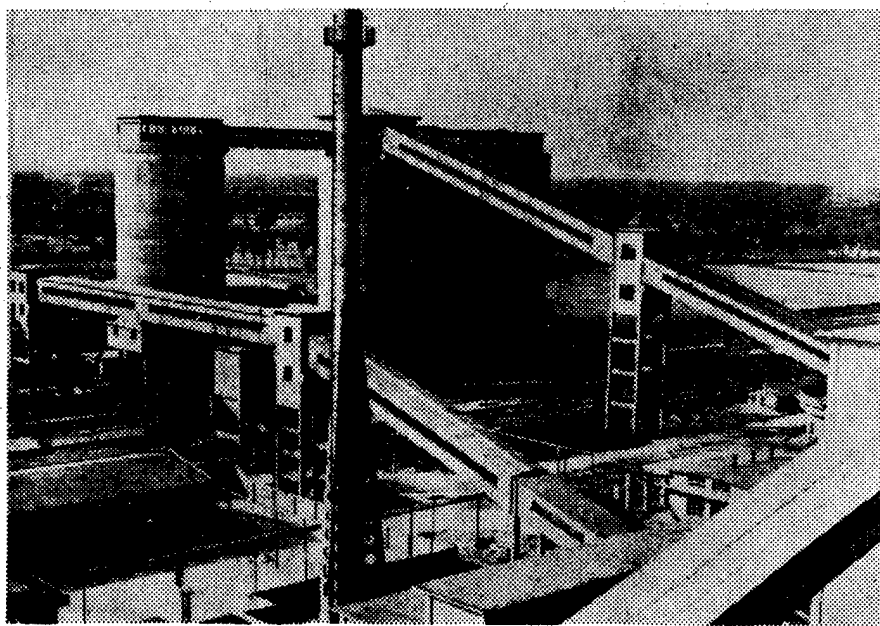
Beijing RENMIN RIBAO in Chinese 26 Aug 82 p 1

[Article: "Coal Dressing Plant in the Datun Coal Field Is Completed and Will Soon Begin Production"]

[Text] A large coal dressing plant that can dress 1.8 million tons of raw coal a year and that is all Chinese-designed, built and equipped--the Datun Coal Field Coal Dressing Plant--has recently been completed and is now being test operated. All equipment has operated normally. It is expected to officially begin production at the beginning of September.

The coal dressing plant in the Datun Coal Field is located inside Pei County in Jiangsu Province on the west bank of Weishan Lake. The plant is one of the key projects of the nation's coal system. After it is completed and begins production, it can provide over 4,000 tons of superior quality coal concentrate a day. It will forcefully support the buildup of industrial production in Shanghai and the east China region.

The total construction area of the plant is 46,000 square meters. The total space of industrial structures is 195,000 cubic meters. It includes 702 pieces of installed equipment.



9296
CSO: 4013/162

COAL

SHANDONG DRAWS UP PLANS TO INCREASE COAL OUTPUT

SK101259 Jinan Shandong Provincial Service in Mandarin 2300 GMT 9 Oct 82

[Text] Comrade (Huang Puyao), deputy director of the Shandong Provincial Coal Industrial Bureau and chief engineer, recently gave a talk to our station reporters, saying that the 12th CPC National Congress has set forth a higher demand for staff and workers on the coal industry front by taking energy resources as one of key strategic points in developing the economy. Therefore, the Provincial Coal Industrial Bureau has successively convened meetings to earnestly analyze our province's conditions for accelerating progress in developing the coal industry while studying the 12th CPC Congress documents. We pledge to assume the glorious and arduous task of historic importance.

Comrade (Huang Puyao) is fully confident in developing the coal industry throughout the province. He stated: Our province has abundant coal resources and is convenient to transportation, which constitutes favorable conditions for developing the coal industry with high speed. Over the past some 30 years, the province has achieved great development in the coal industry, scoring a 2,400 percent increase in raw coal output over the figure of the early stage after the PRC's founding. The province has also greatly upgraded the mine production capacity and the standard of production technology and equipment and steadily developed and expanded the rank of mining staff and workers, laying a solid foundation for accelerating progress in developing the coal industry in the days to come.

Comrade (Huang Puyao) stated: In developing the coal industry with high speed, it is necessary for our province to grasp well the following four tasks:

1. It is necessary to expand the scale in building up new mines and accelerate the speed of building up new mines. Efforts should be made to reach the goal that the province should complete the build-up of new mines with 2 million tons of output each year and complete the build-up of new mines which may yield 55 percent of the output of the provincial annual coal amount by the end of this century.
2. It is necessary to uphold the principle of tapping the latent power and conducting technical innovation and renovations among old collieries to give full scope to the available mines. By 2000, old collieries will be able to fulfill the task of contributing 45 percent of the output of the provincial annual coal amount.

3. It is necessary to do a good job in improving coal tunneling arrangements and steadily upgrading the standard of rational and centralized production. Efforts should be made to gradually mechanize mining operations, change wood pillars to metal ones, automate the means of coal delivery and centralize the control system. Attention should be paid to achieving rapid progress as much as possible in mechanizing and automating mining operations so as to gain better economic returns. To this end, efforts should be made to bring into full play the role of the broad masses of scientific and technical personnel, to strengthen cultural education and technical training among staff and workers on the coal industry front and vigorously upgrade the standard of technology, operation and management.

4. While accelerating progress in developing the coal industry and increasing coal output, it is necessary to do a good job in launching a coal conservation campaign, in upgrading the utilization rate of energy, and in consuming coal in a rational and effective way. Efforts should be made to provide products suitable to consumers so as to create conditions for upgrading the utilization rate of heating energy.

CSO: 4013/24

COAL

HENAN COORDINATES COAL PRODUCTION, SALES

HK120317 Zhengzhou Henan Provincial Service in Mandarin 1100 GMT 10 Oct 82

[Text] The coordination of production and sales of coal has been put into practice in our province. The previous production-transportation-sales system under which coal mines, commerce and railway departments were separate in charge of the production, sales and transportation of coal has been transformed. The problems of coal production being divorced from sales and of overstocking of coal have been solved. Rural and urban production and the daily consumption of coal have been facilitated. This experience was given special attention and popularized in the national coal transportation conference convened recently by the Department of Coal Mines in Datong in Shanxi Province.

Henan is one of the important producers of coal in our country. It produces coal for the industries of the central and central southern provinces and cities and for the daily consumption of the rural and urban populations of these areas. In the past, when the production, sales and transportation of coal were divorced from each other, overstocking, washing away by water and self-combustion resulted. The needs of production and peoples' daily livelihood were far from being satisfied. In order to solve this problem, the provincial people's government adopted measures in accordance with the spirit of the directives of the State Council to change from the coal being solely purchased and sold by the Department of Commerce to permitting the coalmines to produce and sell coal themselves. In close coordination with the Railway Department, more than 3 million tons of pure coal were processed in only 1 year.

Last year, the Provincial Coal Transportation and Sales Company was established to unify the production and sales of coal. The coal in our province, except for the coal reserved for the private use of the coal mines and the coal consumed by the local population in their daily lives, is all included in the Provincial Planning Committee distribution plans and integrated adjustments are made by the Provincial Coal Transportation and Sales Company in coordination with the Railway Department in a balanced manner. The orders of the supplier and the capitalist are organized and the Railway Department transports the coal as planned. In this way, the production of coal is promoted. In addition, the relationship between the coal mines and the railway is coordinated, transportation efficiency increased and the overstocking of coal reduced. As a result, revitalization of the coal economy, the superiority of the Henan coal mines, the ensured planned utilization of coal in Henan and other places, cooperation and coordination outside Henan and the organization of importation are actively promoted.

CSO: 4013/24

COAL

ANHUI PROVINCE TO INCREASE COAL PRODUCTION

OW281626 Beijing XINHUA in English 1604 GMT 28 Oct 82

[Text] Beijing, 28 October (XINHUA)--Anhui Province, one of China's major coal producers, will increase its coal output to 60 million tons in 2000. In 1982, it is producing 24 million tons.

This was announced today by a senior member of the Provincial Bureau of Coal Industry who is attending a national conference here. The province will achieve the target mainly by expanding the coal centers at the both banks of the Huai River, he said.

Construction is now underway for eight new mines at the centers, which are designed to produce an annual average of 14.7 million tons. Acting upon a proposal from a group of Chinese scientists, the province will from now to 1995 start 16 other mines with combined annual production capacity of 34.6 million tons.

The scientists were headed by Professor Hua Luogeng, China's leading mathematician. They made a 3-month on-the-spot investigations and study at the request of Minister Gao Yangwen of coal industry to help work out a plan for the development of the coal centers, a key energy project in the forthcoming years through to the end of this century.

Coal reserves in Anhui are verified at 22,300 million tons.

Construction will begin in 1983 for four new mines designed to produce 6.4 million tons a year, the Anhui official said.

Development of Anhui coal resources is vital to the economic construction of Shanghai and the six east China Provinces, according to earlier news reports, which furnish one-third of China's gross industrial and agricultural output value.

CSO: 4010/16

COAL

SHANDONG BUILDS YANZHOU COAL PRODUCTION, TRANSPORTATION PROJECTS

SK010834 Jinan Shandong Provincial Service in Mandarin 2300 GMT 30 Sep 82

[Text] According to our sources, the construction of the Yanzhou Coal Base, the Yanzhou-Shijiusuo Railway Line and the Port of Shijiusuo, which are called large-scale, linked coordinated projects of the southern part of the province, is in full swing.

The Port of Shijiusuo faces the Yellow Sea and is China's first large-scale port built specially for transporting coal. The first stage of the project calls for building two berths--a 100,000-ton-class berth and a 25,000-ton-class berth--with a designed annual coal exporting capacity of 15 million tons. The construction of these two berths is expected to be completed by 1985. From February 1982, when the construction started, to the end of August, more than 67 million yuan--84.4 percent of the planned annual figure--had been invested in the project. Most of the construction items covered by the 1982 plan have been completed prior to the projected schedule.

The 310-kilometer-long Yanzhou-Shijiusuo Railway Line begins from Yanzhou in the west, connects with the Tianjin-Pukou Railway Line, leads directly to the Yanzhou coalfield and ends at the Port of Shijiusuo. This railway line is used specially for exporting the coal of Yanzhou and Shanxi and is expected to be completed by 1985. At present, the whole project is in full swing. As of 15 September, over 77 million yuan--71.1 percent of the planned annual figure--had been invested in building the section between Yanzhou and Linyi. Meanwhile, 3.39 million cubic meters of earth and stone have been used to build railway beds, bridges with a total length of 5,300 meters and culverts with a total length of 3,200 meters. The track-laying work has formally started.

The Yanzhou coal base, including the Yanzhou and (Zaoteng) mines, covers an area of over 4,100 square kilometers. The Yanzhou coal base abounds in coal deposits and the quality of the coal is relatively good. It is planned to build or extend five pits with a designed capacity of over 12 million tons in this coal base. As of 1990, a large-scale coal base installation with advanced technological equipment will be built. The construction of the base is developing smoothly. The (Xinglongzhuang) Mine with a designed annual production capacity of 3 million tons has been built and put into production. The (Baodian) Mine with a designed annual production capacity of 3 million tons had consumed some 98 million yuan of investments by the end of August, accounting for 69.2

percent of the total investments. The (Baodian) Mine will be completed and put into production in 1984. The (Dongtan) pit, with a designed annual production capacity of 4 million tons, is expected to be completed in 1987. In the first 8 months of 1982, 9.09 million yuan were invested in building the (Dongtan). The construction of the (Liangzhuang) and (Haili) mines and the coal dressing plant of the (Xinglongzhuang) Mine is also in full swing. The completion of these three major projects will play a major role in increasing coal production capacity, expanding coal exports and promoting the national economy.

CSO: 4013/45

COAL

NEI MONGGOL TO BECOME NATION'S SECOND LARGEST COAL BASE

OWO41431 Beijing XINHUA Domestic Service in Chinese 0022 GMT 4 Nov 82

[Report by XINHUA reporter Ai Ding]

[Text] Hohhot, 4 Nov (XINHUA)--Vice Minister of Coal Industry Liu Hui said to a reporter in Hohhot recently: Of the five major open-cut coal mines which we are planning to build, four will be in Nei Monggol. By the end of this century, Nei Monggol will become our country's second largest coal energy base, second only to Shanxi Province.

In September and October, some leading comrades of the Ministry of Coal Industry came to Nei Monggol, where they inspected the Huolinhe and Yiminhe open-cut coal mines, which are already under construction, and the Yuanbaoshan and Zhungeer open-cut coal mines, the construction of which is being planned. They also carried out investigations and study at the Dayan and Zhalainuoer Mining Bureaus.

Liu Hui said: Nei Monggol's coal resources are very rich, and its verified coal deposits exceed 190 billion dun, second only to Shanxi. The quality of its coal is also relatively good. Not only that, but the layers of coal are thick, their earthcovers are shallow and their terrain structures are simple, making open-air exploitation convenient. Since the geographical locations of these coalfields are relatively closer to important industrial areas in the northeastern and northern parts of China, exploration of the coal resources in these places at the fastest possible speed will not only be of great significance in prospering Nei Monggol's economy but will also help relieve the tense situation in the supply to energy in the industrial bases in the northeastern and eastern parts of China. It will make a tremendous contribution toward fulfilling the lofty target of striving to quadruple our country's total yearly industrial and agricultural output value by the end of this century as put forward by the 12th CPC National Congress.

In touching upon the exploration plans, Liu Hui said: At present, the important point of the exploration is in the eastern part of Nei Monggol. While speeding up the construction of large-sized open-cut mines, it is also necessary to build a number of new medium- and small-sized open-cut coal mines and coal pits, step up the transformation of the existing coal mines and assist the localities in developing small-sized coal kilns. In carrying out the construction, it is necessary to apply advanced technology, industrial skills and equipment and to synchronize with the railway and power station construction projects, so as to reach the targets of rapid construction speed and high economic results.

COAL

BRIEFS

SMALL COAL MINES--Beijing, 4 Oct (XINHUA)--China now has more than 16,000 coal mines run by communes, production brigades and teams. During the 3 years from 1979 to 1981, output from these small mines increased by an average 10 million dun annually. Last year their production reached some 120 million dun. In addition to meeting local requirements, some of the coal from these small mines was provided to the state as commercial coal to supplement the supply from state-run mines. The small coal mines run by communes, production brigades and teams produce about one-fifth of all the coal mined in the country. [Beijing XINHUA Domestic Service in Chinese 0057 GMT 4 Oct 82]

NEI MONGGOL COAL OUTPUT--In 1982, Nei Monggol Autonomous Region scored an achievement in coal output. According to statistics, the region's collieries whose products are under the state unified plan fulfilled their monthly raw coal output targets. In the third quarter of this year, the region fulfilled its quarterly coal output plan 2 days ahead of schedule. Raw coal output and exploration footage increased more than 30 and 16 percent respectively over the corresponding 1981 period. [SK100554 Hohhot Nei Monggol Regional Service in Mandarin 1100 GMT 7 Oct 82]

SHANXI COAL OUTPUT--Shanxi produced 11.5 million dun of coal in September, bringing its total coal output in the first 9 months of 106.6 million dun, 13 million dun more than the same period last year. The province's coal mine tunneling footage in the same period was 16.4 percent over the target for the period. [Beijing Domestic Service in Mandarin 1200 GMT 9 Oct 82]

LIAONING COAL OUTPUT--The coal output of Liaoning Province has been increasing year after year. In the first half of 1981, the province witnessed a shortfall in coal output by more than 500,000 tons, having a deficit of 14 million yuan. The Provincial Financial Department subsidized locally-administered collieries by over 28 million yuan. By the end of September, the province overfulfilled 1 million tons of coal, turning deficits into profits. [Shenyang Liaoning Provincial Service in Mandarin 1100 GMT 11 Oct 82]

COAL CONSERVATION--Beijing, 18 Oct (XINHUA)--China saved 64.82 million tons of coal in the past 2 and one-half years from January 1980, according to the State Economic Commission. Of the total, about two-thirds was saved by restricting production of heavy industry while boosting that of light industry, which uses less fuel per unit production. The remainder was saved by improving management and carrying out technical transformation. Coal accounts for 70 percent of China's primary energy output. While making efforts to expand the energy industry, the country has launched a nationwide conservation drive.
[Text] [Beijing XINHUA in English 1233 GMT 18 Oct 82 OW]

CSO: 4010/22

OIL AND GAS

NATION'S STRIDES IN OIL DRILLING WORK HIGHLIGHTED

HK150734 Beijing ZHONGGUO XINWEN SHE in Chinese 1245 GMT 13 Oct 82

["Much Headway Made in China's Oil Drilling Work Over Past Few Years"--ZHONGGUO XINWEN SHE headline]

[Text] Beijing, 31 Jul (ZHONGGUO XINWEN SHE)--In the past few years China's oil drilling level has been improved to a great extent and has entered the stage of scientific drilling.

China has now set up drilling teams capable of all types of production work. The number of drilling teams has increased from a handful in the 1950's to over 700, and the number of drilling staff and workers total 190,000. Apart from this, there is now a considerable number of scientific drilling research teams.

By now the drilling level has been improved in an all-round way and drilling has continued to increase in speed. In the field of well cementation, concrete can now be injected into oilfields at several levels and special technology for well cementation has been adopted. In terms of obtaining cores, short cylinders have been replaced by long cylinders and the rate of obtaining cores has been increased by several percent. Recently, a 46-metre core was removed from a drilling well running to a depth of 4,500 meters in the limestone of Sichuan oilfields. The rate for obtaining core was increased by 100 percent. The quality of wells has been improved to a great extent. The national monthly average speed rate registered a sixfold increase in 1981 compared with 1949. Daqing No 1205 drilling teams and Shengli oilfield No 3252 drilling team have achieved the highest annual records for drilling footage, of 120,000 and 150,000 meters respectively. Huabei oilfield No 4 company has a total of 16 rigs. Wells have been sunk to a depth of over 3,000 meters. Each drilling team has achieved an average annual drilling footage of 15,000 meters. The achievements of these teams have reached the world's advanced levels.

The drilling technology level has been raised markedly over the past few years. Gushers, drills of high efficiency, first grade concrete and other new types of technology have been widely used, and special drilling technology has also been developed. Formerly, we could only sink shallow wells, but we are now able to sink deep or super-deep wells. Before, we could only sink ordinary wells but

we are now able to sink high pressure gaseous wells and special technology wells. previously, we were only capable of straight drilling but we are now capable of directional drilling and cluster-type drilling. We are now capable of both inland and offshore drilling. Since the foundation of the country, we have sunk a total of 242 wells with a footage of over 4,000 meters, of which 211 were completed in the past 4 years. The average well's construction period was shortened by 295 days in 1981 compared with 1977. Now China is capable of sinking a well with a drilling footage of over 7,000 meters.

Drilling equipment has been greatly improved. China can now mass produce land-used rigs able to bore footages of 1,200, 3,200 and 4,500 meters respectively, and can produce 23 different types of drills. Now 50 percent of the drilling teams are equipped with Chinese-made advanced rigs.

In terms of offshore drilling, China has now established an offshore oil exploration bureau and South Sea oil exploration headquarters, equipped with over 10 drilling platforms. Oil exploration has been initiated in Bohai Bay, the Yellow Sea, East China Sea and South China Sea and a number of high-yield oil and gas wells have been sunk.

According to a person concerned in the Ministry of the Petroleum Industry drilling is the basic means for completing oil source exploration and gas exploitation and it is an important guarantee for a stable annual yield of 100 million tons of crude oil. He added that the actual drilling work is excellent. In the first half of this year, the drilling footage amounted to approximately 3,700,000 meters. According to the annual plan for this year, a drilling footage of 7,000,000 meters is likely to be achieved, establishing the highest record of drilling footage since the founding of the state.

CSO: 4013/30

OIL AND GAS

WANG ENMAO SPEAKS ON UPGRADING XINJIANG PETROLEUM INDUSTRY

HK100310 Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 9 Oct 82

[Excerpts] On the afternoon of 8 October, regional CPC committee first secretary Wang Enmao made a speech at a rally convened by the Karamai Municipal CPC Committee of the Xinjiang Petroleum Administrative Bureau in implementing the spirit of the 12th party congress and creating a new situation in Xinjiang's petroleum industry. He stressed: The petroleum industry accounts for a major proportion of the region's national economy. At present the region's oilfield development speed and exploitation level are very far from meeting the needs of the state's modernization drive. In the next few years the focus in China's on-shore oil exploitation will be on the northwest, the focus in the northwest will be on Xinjiang, and the focus in Xinjiang will be on the Junggar and Tarim basins; and the focus in the Junggar basin is on Karamai. The workers on Xinjiang's petroleum front shoulder extremely glorious and arduous responsibilities. He called on the petroleum workers of all nationalities to make still greater contributions to creating a new situation in Xinjiang's petroleum industry, encouraged by the spirit of the 12th party congress.

Leading comrades of the party and government in the region Ismail Amat, Huang Luobin, Qi Guo, Amudong Niyazi and Bai Chengming, and Petroleum Ministry adviser Zhang Wenbin attended the rally.

In his speech, Comrade Wang Enmao highly praised the tremendous contributions of the petroleum workers of all nationalities in the struggle to exploit and build up the Karamai oilfield in the past 26 years, and especially since the 3d plenary session of the 11th Central Committee. He said: In order to implement the 12th party congress spirit and stimulate still faster development of Xinjiang's petroleum industry, the petroleum front must redouble efforts and do a good job in the following tasks:

1. Party and government leaders at all levels must get a good grasp of conveying, studying and implementing the 12th party congress documents.
2. We must work hard to attain the target for endeavor of quadrupling crude oil output by the end of the century. This target has not been set in an arbitrary way; it has been scientifically calculated and has a relatively reliable basis.

3. It is necessary to strengthen the building of socialist spiritual civilization centered on communist ideology.

4. We must continue to strengthen the unity of nationalities and further consolidate and develop the political situation of stability and unity.

5. We must seriously get a good grasp of current production. He expressed the hope that the cadres and workers of all nationalities on the petroleum front would rise on the east wind of the 12th party congress, make still greater efforts, and strive to overfulfill this year's plans and produce more crude oil for state.

Regional CPC committee secretary and government chairman Ismail Amat also spoke at the rally. He said: We should strive to quadruple the region's total annual value of industrial and agricultural production and strive to go further still, so that our per capita national income will approach and catch up with the national average. Developing Xinjiang's petroleum industry plays a decisive role in this endeavor. Xinjiang must grasp oil in order to become rich. Xinjiang must greatly increase oil production in order to become much richer. We believe that, guided by the spirit of the 12th party congress, with the correct leadership of the Central Committee and the close unity and common efforts of the people of all nationalities in Xinjiang, the workers of the Xinjiang petroleum front, with their fine traditions, will certainly make still greater contributions to the cause of socialist construction in the motherland and Xinjiang.

Comrade Wang Enmao and the other leading comrades of the party and government in Xinjiang arrived in Karamai on 5 October.

CSO: 4013/30

OIL AND GAS

XINJIANG OIL INDUSTRY MAPS DEVELOPMENT PLANS

HK110349 Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 10 Oct 82

[Excerpts] By the year 2000, Xinjiang's oil reserves, crude oil output and processing, and oil industry total output value will be quadrupled compared with now. This stimulating and vast target was recently put forward by the CPC committee of the Xinjiang Petroleum Administrative Bureau in its development plan for 1983 to the year 2000, drawn up in accordance with the 12th party congress spirit.

(Zhang Yi) deputy secretary of the CPC committee, reported on this plan on 7 October to leading comrades of the party and government in the region who had come to inspect and guide work at the Karamai oilfield. Regional CPC committee first secretary Wang Enmao and government chairman Ismail Amat praised the plan as possessing revolutionary spirit and also taking a realistic approach. They called on all cadres, workers and dependents on the oil front to display the spirit of arduous pioneering and work hard to achieve this vast target.

The bureau CPC committee's development plan for the next 18 years is in three stages, the first being from 1983-1985, and the second from 1986-1990. During these 8 years, it is necessary to concentrate on geological prospecting and also do a good job in tapping potentials in the old production areas and in building up the new areas, to lay the foundation for future development. The third stage is from 1990-1991 to the year 2000. During these 10 years, it is necessary to vigorously develop the oil industry on the basis of the previous stage.

In its scheme, the bureau CPC committee put forward specific measures for fulfilling these plans as well as the strategic aims and arrangements. These measures are mainly as follows:

1. Uphold the principle of putting prospecting first and open up more extensive fields for finding oil, so as to endeavor to get hold of more reserves.
2. Carry out rectification and reform in the enterprises, centered on improving economic returns.

3. Develop science and education and increase investment in brains. It is necessary to set up an oil college, and do a good job in running various types of secondary technical schools and worker sparetime education, to improve the science and cultural levels of the workers.

By the end of September, the bureau had fulfilled the year's well-drilling plan. The quotas for oil extraction and refining had been respectively 76 and 86.7 percent fulfilled. Other economic and technical targets have also been fulfilled well.

CSO: 4013/30

OIL AND GAS

BRIEFS

JILIN OIL PRODUCTION--Jilin Province has established a comprehensively branched and reasonably distributed petroleum industry with fairly high technical standards. The province now has a crude oil production capacity of 1.7 million tons and a crude oil processing capacity of 3.38 million tons, and is capable of producing 45 kinds of products, including fuel oil, lubricating oil and grease. It has greatly accelerated the development of the industry and improved its economic results. Compared with the end of 1978, output value and profit both show a 100-percent increase now. [Changchun Jilin Provincial Service in Mandarin 1100 GMT 2 Oct 82 SK]

SICHUAN NATURAL GAS PRODUCTION--Staff and workers on the Sichuan petroleum front have energetically promoted natural gas output, thus making contributions to solving the problem of energy shortages and responding to the call of the 12th party congress for comprehensively opening up new prospects for socialist modernization. The Sichuan Petroleum Administrative Bureau overfulfilled its natural gas production plan for August by more than 5.2 million cubic meters and overfulfilled its natural gas well-drilling plan for August by more than 5,000 meters. During the first 12 days of September, the bureau fulfilled 41 percent of its natural gas production plan for September. [HK171437 Chengdu Sichuan Provincial Service in Mandarin 0030 GMT 17 Sep 82 HK]

CSO: 4013/30

NUCLEAR POWER

CHINA'S NUCLEAR POWER DEVELOPMENT AND THE 'FRENCH CONNECTION'

OW300932 Hong Kong AFP in English 0822 GMT 30 Aug 82

[Report by Charles-Antoine de Nericiat]

[Text] Shanghai, China, 30 Aug (AFP)--A high Shanghai official has indicated that work on the first nuclear station to be entirely built by China has not yet begun in that large eastern port city.

Han Zhiyi, one of the city's deputy mahors, said in a recent interview here with Chairman of AFP Henri Pigeat that the equipment for the station was being manufactured. And "we have the technology and experience in that field," said Mr Han, adding that work on the 300-megawatt nuclear station near Shanghai was "being advanced."

Chinese experts were examining the site where the station was to be built, the deputy mayor said.

In a recent interview with AFP, Chinese Communist Party Chairman Hu Yaobang said the Chinese nuclear power program expected the production of more than 10 million kilowatts in 10 to 20 years.

Besides wholly Chinese-built stations, Mr Hu said China also planned to "import stations of hundreds of thousands, or even two to three million kilowatts, but only on favorable terms."

A French mission has just visited Beijing to resume negotiations on the project for the construction by France of a nuclear station with two sections of 900 megawatts in Guangdong Province. China is expected to supply part of the electricity to Hong Kong.

Referring to the Guangdong project, the deputy mayor said that France will "take into consideration the international competition." The Americans, British and Japanese have also shown interest in the Guangdong project. Mr Han said that he hoped France would take an "enlightened attitude" on the project, undoubtedly suggesting that negotiations between the two countries have not always led to financial arrangements agreeable to China.

CSO: 4010/13

NUCLEAR POWER

NUCLEAR POWERPLANT TO BE LOCATED AT HANGZHOU BAY

OW122148 Beijing XINHUA Domestic Service in Chinese 1345 GMT 10 Nov 82

[Text] Beijing, 10 Nov (XINHUA)--According to JINGJI CANKAO [ECONOMIC REFERENCE] published today, the State Economic Commission has approved the location of the first 300,000-kw pressurized-water reactor nuclear powerplant to be designed and manufactured in China. It will be located in Qinshan of Haiyan County, Zhejiang Province, near the load center of the East China Power Grid. At present, the developing of equipment and the initial designing for the expansion of the project are being stepped up. Preparations for construction will also begin very soon.

Qinshan is located at Hangzhou Bay and the nuclear powerplant will be situated in the mountains facing the sea. The geological quality in the surrounding area and at the powerplant is stable and conditions for transportation and water drainage are convenient.

Nuclear power generation is a rich and yet safe and clean energy source. The energy generated from kg of nuclear fuel (uranium-235) is equivalent to the amount of energy from 2,700 tons of standard coal. Nuclear power generation will not only reduce the bulky volume of fuel thus eliminating the transportation problem for large amounts of coal or petroleum, but also keep the per kwh cost generally lower than other thermal power stations.

Our country has verified the resources of a certain amount of uranium and built a relatively comprehensive system for developing nuclear fuel and other related industries, thereby providing excellent conditions for the development of nuclear power generation.

Our country's energy resources are still relatively poor at present and the distribution of natural resources is very uneven with 70 percent of the hydraulic resources in the southwest and 60 percent of the coal resources in north China. Therefore, it is absolutely necessary to actively develop nuclear power generation in the seriously energy deficient areas in east China, south China and the northeast.

CSO: 4013/53

CONSERVATION

JIANGXI HOLDS CONFERENCE ON ENERGY CONSERVATION

OW071150 Nanchang Jiangxi Provincial Service in Mandarin 1100 GMT 4 Nov 82

[Excerpts] JIANGXI RIBAO reports: The Jiangxi Provincial Economic Committee held a telephone conference on 2 November. The conference implemented the guidelines of the national telephone conference on unfolding the fourth Energy Conservation Month activities and called for mobilizing the workers and staff on the industrial and transport front to promote the energy conservation month activities in the province.

Vice Governor Liang Kaixuan attended and addressed the conference. The conference held: The province has scored substantial results in energy conservation this year.

Since 1980 the province has carried out 272 technical renovations.

According to incomplete statistics, Jiangxi Province saved 98,000 tons of coal, 76.92 million kwh of electricity and 8,300 tons of fuel oil in the first half of this year.

The conference stressed: In accordance with the guidelines of the national telephone conference on unfolding the fourth Energy Conservation Month activities and in light of the actual conditions in Jiangxi Province, we must pay attention to the following points in promoting energy conservation activities:

1. Earnestly study and understand the guidelines of the 12th CPC National Congress and regard promoting the Energy Conservation Month activities as an important measure for achieving the strategic objective of vigorous economic development. Currently the shortage of energy supply is extremely acute.

Except for ensuring minimum supply of electricity for the coal and chemical industries, all other enterprises in the province have been on electricity rationing or have had no electric supply at all. Therefore, it is not only necessary but also imperative to conserve energy.

2. Strengthen scientific management of energy supply and consumption.

3. Carry out technical renovations and revamp the old equipment aiming at conserving energy.

4. Strengthen leadership over energy conservation work and establish and perfect the energy conservation organs.

5. Work out energy conservation plans for next year and make necessary preparations for production.

CSO: 4013/52

CONSERVATION

JIANGSU PARTY SECRETARY ADDRESSES ENERGY CONSERVATION MEETING

OW020511 Nanjing Jiangsu Provincial Service in Mandarin 2300 GMT 29 Oct 82

[Excerpts] Following a national teleconference on the fourth Energy Conservation Month called by the State Economic Commission, the Jiangsu Provincial People's Government held a provincial telephone meeting on the evening of 29 October.

At the provincial teleconference, Gu Xiulian, secretary of the provincial party committee, made a speech on how to successfully conduct Energy Conservation Month activities in the province this year. In reviewing the gratifying achievements made in conserving energy in the province this year, Comrade Gu Xiulian said: Despite the energy shortage, the province's total industrial output value in the January-September period increased 9.9 percent, compared with that in the same period last year. From January to September this year, the province saved 750,000 tons of coal, 280 million kilowatt-hours of electricity and over 35,000 tons of processed oil.

At the same time, Comrade Gu Xiulian pointed out: A few units have stressed production to the neglect of energy conservation. As a result, they have failed to carry out effectively their measures to conserve energy.

Comrade Gu Xiulian called on people in all localities to clearly understand the importance of energy conservation and to link this work with the efforts to attain the grand goal set by the 12th party congress.

In conclusion, Comrade Gu Xiulian called for conscientiously carrying out the guidelines and arrangements made by this meeting and taking effective measures to conduct energy conservation activities in order to score new achievements in this regard.

CSO: 4013/52

CONSERVATION

GUANGDONG POWER ORGANS MAKE APPEAL FOR ELECTRICITY CONSERVATION

Guangzhou NANFANG RIBAO in Chinese 22 Aug 82 p 1

[Article by Wen Wei [2429 0251], Peixun [0160 8113], Dekuan [1795 1401]: "Provincial Electric Power Department Appeals to the Localities To Conserve Electricity. Because the Water Level of the Reservoirs of Hydroelectric Power Stations Has Dropped and Because of the Shortage of Oil and Coal, the Whole Province Will Reduce the Supply of Electricity by 1.7 Million Kilowatt Hours Every Day Beginning in September"]

[Text] Because the water level of the reservoirs of the hydroelectric power plants in our province has dropped and because of the shortage of oil and coal supplies, starting from September, the whole province will reduce its daily output of electricity by 1.7 million kilowatt-hours from July, a reduction of 6.4 percent. The daily supply of electricity to Guangzhou City will also be reduced. Concerned departments of the province have appealed to every factory and enterprise and the people and masses to conserve electricity and overcome the difficulty together.

Since the beginning of this year, because of national economic development, production of heavy industry which uses over one half of the electricity of the whole province has risen again. From January to July, consumption of electricity increased by 12.3 percent over the same period last year. Light industry continued to develop and the consumption of electricity has increased 21 percent. The living standards of the people have risen and the consumption of electricity has increased 26.8 percent. The consumption of electricity by other professions has also increased. As the consumption of electricity has rapidly increased, the provincial electric power departments have generated more hydroelectric power from January to July of this year based on the relatively high water level in the reservoirs at the end of last year and forecasts of an abundance of water this year by concerned departments. But, during the first half of this year, rainfall concentrated in a few counties in Shaoguan and Zaoqing Prefectures, causing damage. The water flowing into the large reservoirs of the power network between January and July dropped 16 percent from the same period last year. At the end of July, the water level of the reservoirs of all major hydroelectric power stations in the province generally dropped below the level of the same period last year. The water level of the Xinfengjiang Reservoir of the province's largest hydroelectric power station was 4 meters lower than last year's level. The water level of the Fengshu Dam

Reservoir was 3.79 meters lower and that of the Liuxihe Reservoir was 8.78 meters lower. It is expected that the incoming water during the next few months will not be too much and it is not possible to continue to generate more hydroelectricity. Therefore, plans have been made for all hydroelectric power stations to generate less electricity starting in September. On the other hand, because of the shortage of oil and coal, thermal power stations also cannot generate more electricity.

To solve the problem of the shortage of electric power supply, concerned departments of the province are actively taking measures at present to generate and supply more electricity.

9296

CSO: 4013/161

CONSERVATION

GUANGDONG ISSUES EMERGENCY CIRCULAR ON POWER CONSERVATION

HK140310 Guangzhou Guangdong Provincial Service in Mandarin 1000 GMT 12 Oct 82

[Text] On 10 October the Guangdong Provincial People's Government issued an emergency circular on the strict implementation of planned power consumption. The circular called on the various localities to vigorously support the efforts of the power departments in supplying power according to the plan and to adopt effective measures to utilize power in strict compliance with the quotas set by the provincial authorities.

The circular stressed that at present the extra power supply situation in our province is still very serious. Since the middle of September, there has been an average daily extra supply of more than 2 million kwh. If this state of affairs is not brought under control, it will certainly exhaust the existing fuel of thermal power plants and the existing water resources of the hydro-electric power plants, thus bringing about a power cut over a large area in the coming winter and spring next year.

The circular stressed that in the event of a serious power shortage, it will be necessary to ensure power supply to key units, make overall arrangements and supply power to selected units. With respect to products which are of very poor quality and whose consumption of energy is too high, or which are unmarketable and kept in stock for a long period, it is necessary to suspend their production in order to alleviate the current power supply shortage. Efforts should be made to strictly limit power consumption in enterprises run by the communes and production brigades in order to ensure power supply for agricultural irrigation and drainage.

The circular called on Guangzhou and various medium-sized cities to act immediately and resolutely abolish, within this year, the system of paying fixed charges for power consumption. Electric meters should be installed within a stated time as otherwise the power supply will be cut or a fine will be imposed.

CSO: 4013/52

CONSERVATION

BRIEFS

ZHEJIANG ENERGY CONSERVATION--Since the beginning of this year, Zhejiang Province has obtained good results in energy conservation. From January to September, it saved 300,000 tons of coal, 20,000 tons of oil and 55 million kwh of electricity. Total industrial output value topped the same period last year by 8.2 percent, while energy supply only rose by 3 percent over the same period last year. [Hangzhou Zhejiang Provincial Service in Mandarin 1030 GMT 28 Oct 82 OW]

SHANDONG ENERGY CONSERVATION--According to statistics released by 320 enterprises in Shandong Province, during the January-September period, these enterprises each with an annual energy consumption of 10,000 tons of standard coal, increased their production value by 3.42 percent and reduced energy consumption by 0.31 percent compared with the corresponding 1981 period. The average energy consumption for producing 10,000 yuan worth of products declined by 3.64 percent. In the past 9 months, the whole province conserved energy amounted to 85,000 tons of standard coal. [Jinan Shandong Provincial Service in Mandarin 2300 GMT 4 Nov 82 SK]

CSO: 4013/52

SUPPLEMENTAL SOURCES

PLANS TO HARNESS NATION'S HUGE TIDAL POWER RESOURCES STUDIED

Shanghai ZIRAN ZAZHI [NATURE JOURNAL] in Chinese Vol 5 No 7, Jul 82 pp 496-99

[Article by Guo Chengtao [6753 2052 3447] of Huadong Normal University: "Tidal Power Generation"]

[Excerpts] Tidal energy is found in all oceans of the world. The amount of reserves is very abundant. China's sea coast is about 18,000 kilometers long and the reserve is also sizable. How to utilize tidal energy to generate electricity to benefit mankind is a very important subject. In 1980, the Jiangxia Tidal Power Station, our nation's first such power station having a modern technical standard, was completed in Wenling County in Zhejiang Province.

I. Characteristics of Tidal Energy

According to estimates, the world's reserve of tidal energy can reach over 1 billion kilowatts. Fully utilized, it can generate 1,240 billion kilowatt-hours of electricity a year. The reserves in bays are the most abundant, for example, the English Channel has 80 million kilowatts and our nation's Yellow Sea has about 55 million kilowatts.

China's total reserve of tidal energy is about 110 million kilowatts. The annual amount of electricity that can be utilized reaches 90 billion kwh, ranking fourth in the world. The proportion in the two provinces of Fujian and Zhejiang is the largest.

Tidal energy has many features:

A. It is a kind of reproductive energy resource. It completes a cycle every day, and is inexhaustible.

B. It is a stable and reliable energy source. The rise and fall of the tides have a very strong regularity. At present, we can accurately forecast tides of longer periods. It is unlike the hydraulic energy resources of rivers which have years of abundant water, dry years and seasons of abundant water and dry seasons during which the amount of water changes unpredictably.

C. It is an economical energy source. Tides rise and fall by themselves each day and "offer energy right to the door."

D. It is a clean energy source and does not pollute the environment.

E. It is a kind of energy source that has fewer problems. It does not flood large areas of farmland, cities, factories, mines, railroads, and highways and it does not involve evacuation of the population and other such complex problems.

F. Besides the benefit of generating electricity, it can also produce simultaneous benefits from comprehensive utilization. According to understanding, while building tidal power stations at the mouth of the Chang Jiang, Qiantangjiang, Leqingwan Prefecture in Zhejiang, a fairly large area of farmland could be encircled and reclaimed. After the sluice gates of the tidal power stations at the mouths of rivers and bays are built, the water level at the upper reaches of the river or the reservoir area upstream from the sluice gates can be controlled. This controls or reduces the height of the waves, facilitates navigation, and allows boats to avoid the winds. Because the completed sluice gates control the water level in the reservoir, they are beneficial to flood prevention, draining waterlogging, irrigation, breaking tides, protecting the banks of farmland and towns along the coast. The reservoir formed by a tidal power station is beneficial to developing aquatic culture and tourism.

II. Tidal Power Stations

Tidal power stations convert tidal energy into electrical energy. A sluice dam is built at the mouth of a river or in a bay to form a reservoir and water turbine generators are installed in the power station on the inside of the sluice dam or beside the dam. When sea water rises and falls, the amount of intake and outflow of water of the reservoir is controlled, forming a difference between the water levels inside and outside the reservoir. Then this difference is utilized to divert water flow through the water turbine generator.

There are many ways of using tidal power to generate electricity. Categorized by the form of development, there are the following three types:

A. Single reservoir and unidirectional type. Only one reservoir is built and the amount of water intake and output of the reservoir is regulated to satisfy the needs for generating electricity. The diagram is shown in Figure 1. When the power station operates, unidirectional water flow at falling tide is diverted through the water turbine generator to generate electricity. Its concrete operating method is to open the sluice gate at high tide to let the tide water into the reservoir. At level tide, the sluice gate is closed and at receding tide, the gates of the water turbines are opened to let water flow through the water turbine generator to generate electricity.

This kind of power station requires building only one sluicing dam. The structure of the water turbine generator only has to satisfy the requirements for unidirectional water flow to generate electricity. Thus the structure and the hydraulic engineering structures of the generator are relatively simple, the construction cost is less, but generation of electricity is possible only in one direction at receding tide, therefore the time of electric power generation each day is very short, there is less output of electricity, and tidal

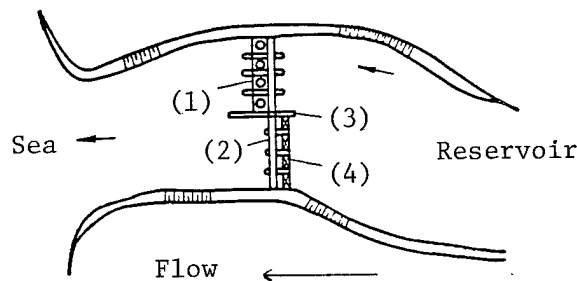


Figure 1. Single Reservoir Unidirectional Tidal Power Station

Key:

- | | |
|-----------------------------|---------------------|
| (1) Water turbine generator | (3) Separation wall |
| (2) Bridge | (4) Sluice gate |

energy is not fully utilized. For the users that require a longer period of power supply, this is not favorable.

B. Single reservoir bidirectional type. This type is the same as the previous type in that it still uses one reservoir to regulate the intake and out-flow of water. The difference is that this type can generate electricity in both directions of water flow at high tide and low tide. Bidirectional generation of electricity at high tide and low tide can be realized in two ways: One way is to build corresponding hydraulic engineering structures. The other is to incorporate corresponding measures in the structure of the water turbine.

The method to realize bidirectional generation of electricity by hydraulic engineering structures is shown in Figure 2. At high tide, water is taken in along the channel illustrated by the solid line to generate electricity. When the tide recedes, water is discharged along the channel illustrated by the dotted line to generate electricity. For the water turbine, the direction of flow and the direction of rotation do not change at high tide or receding tide.

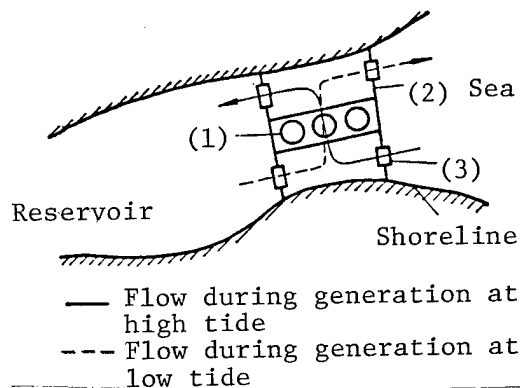


Figure 2. Single Reservoir Bidirectional Tidal Power Station

- Key: (1) Water turbine generator (2) Dam (3) Sluice gate

The method to realize bidirectional generation of electricity by the water turbine generator is mainly to enable the generator itself to satisfy both forward and backward reversible operation in the direction of rotation and in the direction of the rotary blades of the water turbine. The hydraulic engineering structures are basically the same as those for the single reservoir type for generating electricity. However, to satisfy the efficiency requirements in bidirectional generation of electricity, the shape of the channels of water flow is changed.

Bidirectional generation of electricity can operate for a longer time and the output of electricity is also larger. But these two types of electricity generation both have a shortcoming, the generation of electricity is discontinuous. The former ceases to generate electricity during high tide and at level tide. The latter still has to cease generation at level tide.

C. Double reservoir unidirectional type. This type requires building two neighboring and connected reservoirs. The water turbine generator is placed between the two reservoirs (as shown in Figure 3). The left reservoir has an intake flood gate specifically to draw water into the reservoir when the tidal water level is higher than the water level inside the reservoir. The right reservoir has a sluice gate specifically to discharge water from the reservoir when the tidal water level is higher than the water level inside the reservoir. In this way, the former always maintains a higher water level and is called the high reservoir. The latter always maintains a lower water level and is called the low reservoir. A differential water level is always maintained between the high reservoir and the low reservoir. The water turbine generator is situated between the two reservoirs. Waterflow continues throughout the day through the water turbine generator to generate electricity continuously. This type requires building two or three embankment dams and two floodgates. The amount of construction and the investment are large and the differential water level that can be utilized is much smaller than the two previous types, therefore the output of electricity is also small.

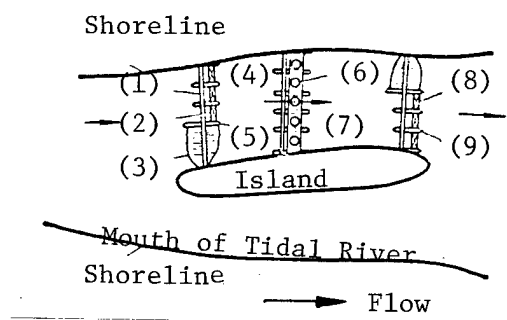


Figure 3. Double Reservoir Unidirectional Tidal Power Station

Key:	(5) Separating wall
(1) Bridge	(6) Water turbine generator
(2) Intake sluice gate	(7) Low reservoir
(3) Dam	(8) Exit sluice gate
(4) High reservoir	(9) Sluice gate buttress

The various developmental types described above all have their advantages and shortcomings. They should be selected on the basis of the local form of tides, the tidal difference, topographic conditions, the load requirements of the power system, the composition of the power generation equipment, construction materials, construction conditions and such technical and economic indices.

The construction of a tidal power station is a combined effort of several single construction projects, mainly the embankment dam, the flood gate and the power plant.

The embankment dam built at the mouth of a river or in a bay functions to separate the area of water in the mouth of the river or in the bay from the outer sea to form a reservoir. There are many types of embankment dams. The low embankment dams built along the coastal regions have been using more rubber dam structural types and blasting methods to construct and treat the foundation in recent years. These types of dams and the construction methods require less amount of construction and investment, and are favorable to the economical character of high tide power generation.

One function of the floodgate is to fill and discharge the water in the reservoir during normal operation, regulate the water level in the reservoir, hasten the formation of the difference in the water levels inside and outside the reservoir, and thus shorten the time of shutdown of the power station and increase the output of electricity. Another function is to hasten the drainage of water inside the reservoir during floods, waterlogging and big tides, or to block the inflow of tidal water to control the highest and the lowest water levels inside the reservoir so that the normal water level for power generation can be restored as quickly as possible. At the same time, it serves to satisfy water conservancy requirements of preventing floods, draining waterlogging, blocking tides, resisting drought and navigation. The width of the sluice gate is larger, the amount of water diverted and discharged is larger, and it can better satisfy the above requirements, but the amount of construction and investment correspondingly increases.

There are many structural types of floodgates. The floor board, floodgate walls and such components of the prefabricated flood gate developed in recent years are prefabricated in concrete factories or precast on the two banks of the construction site. The prefabricated gate is then installed. Then the assembly is transported on wheels or floated to the site of the flood gate, sank into the water and assembled. Some floor boards and walls of flood gates are made of reinforced concrete slabs and some use the reinforced concrete hollow box structure. The unit rigidity of the empty box structure is better. Seepage prevention, slippage prevention and treatment of the foundation are all easier than for the slab type, and the box structure conserves steel members, but the structural components are thinner, therefore durability is poorer than slab structures. At present, the empty box structure is used more frequently.

During construction of the prefabricated flood gate, cofferdams or ditches on the bank are not required. The method of construction is relatively simple, the amount of construction and investment is small and the amount of labor is also small. It is suitable for mouths of rivers which have a relatively wide

water surface and a deeper depth or in harbors and bays. Also, during construction, the flow of water does not need to be interrupted. This avoids conflicts between construction and navigation and draining flood waters. It is not affected by the flooding season. Therefore, construction can be carried out throughout the year. This favors hastening construction speed. There is another important characteristic, it can better adapt to the rock foundation and the soft soil foundation. Because of the above advantages, it is used a lot at present along the coastal regions, such as Guangdong and Jiangsu.

The hydroelectric power plant includes the water turbine generator, transmission equipment, lifting facilities, central control room and lower-level water flow channels and flood gates. The most important equipment is the water turbine generator. Water turbine generators can basically be divided into the vertical shaft type and the horizontal shaft type.

The vertical shaft generator facility connects the axial flow water turbine and the shaft of the generator vertically. This type of generator has a large curvature between the intake of water and the exit of the tailwater. A lot of hydraulic energy is lost, and it requires a larger shell for the water conduit and a large area for the plant housing. This is not ideal for tidal power stations with a small difference in water levels and a larger flow.

The horizontal generator is used more often. The bulb-shaped flow-through generator developed in recent years is better. France built the bulb-shaped flow-through generator after many years of research during the course of building the Rance Tidal Power Station in order to fully utilize the tidal energy of low waterhead and reduce the loss of energy when water flows through the water turbine. Structurally it has the following major characteristics. The water turbine and the generator are connected by one axle. The generator is sealed by steel plates. The entire facility lies in the lower-level channel of flow at the bottom of the plant housing. When the water flows through the channel, it rotates the blades of the water turbine generator to generate electricity. Its structural section is illustrated in Figure 4. The main characteristic of the bulb flow-through water turbine is that the channel of water flow is straight and it has a shorter length, therefore, the loss of hydraulic energy is small and the efficiency in generating electricity is higher. The outer dimensions of the generator are smaller and the dimensions of the plant housing required are also smaller. Thus the amount of construction and investment is small. Many years of operation at domestic and foreign tidal power stations have proved that the shape of this generator produces good results, therefore, it is widely used at present.

In recent years, foreign nations have also developed another new type of generator, it is the blade edge flow-through type generator. Its main structural characteristic is to fix the rotor of the generator directly onto the tip of the rotary blades of the water turbine. The stator is fixed on the wall of the channel of waterflow surrounding the rotary blades. This type of generator requires sealing the stator and rotor of the generator so that they will not be infiltrated by water. This can eliminate the bulb structure. According to estimates, the construction cost can be 20 percent less than that of the bulb-shaped flow-through generator. Civil engineering investment is also correspondingly less.

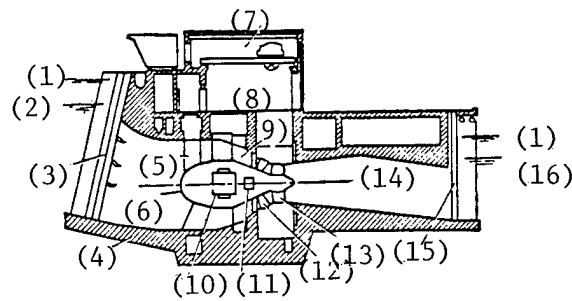


Figure 4

Key:

- | | |
|-----------------------------------|-----------------------------------|
| (1) High water level | (9) Buttress |
| (2) Low water level | (10) Generator |
| (3) Intake sluice gate trough | (11) Speed multiplier |
| (4) Reinforced concrete structure | (12) Division blade |
| (5) Manhole | (13) Runner blade |
| (6) Bulb | (14) Tailwater pipe |
| (7) Crane | (15) Tailwater sluice gate trough |
| (8) Plant housing | (16) Low water level |

The following is a brief introduction to the major tidal power stations already completed in our nation and abroad:

1. The Jiangxia Tidal Power Station in Zhejiang Province. This is our nation's first medium tidal power station having a modern technical standard. It was completed in May 1980. Results of over a year of operation have been good. The natural conditions of this power station are better. The area of water inside the bay is large, the entrance of the bay is narrow, like a cloth bag. The tidal difference is larger. The maximum tidal difference can compare with the famous Qiantangjiang tidal difference. Therefore, the amount of construction and the investment in the embankment dam are small. The output of electricity is larger. The power station uses single reservoir bidirectional generation of electricity. The power station mainly includes the embankment dam, the sluice gate, and the power plant. Its plane diagram is shown in Figure 5. The water turbine generator uses the bulb-shaped flow-through generator. The generator ceases to generate electricity during level tides and can serve as a sluice gate to discharge water. The efficiency of generating electricity by the generator is high.

Sea water has a high salt content. Corrosion of the water turbine, steel members and such metallic structural components is relatively serious. The Jiangxi Power Station uses the methods of cathode protection and paints. These methods were much more economical than the method of those power stations that used stainless steel to solve such problems. Living organisms of the sea can quickly adhere to the surface of structures in the sea and the water turbine. The water turbines and sluice gates at some power stations could not operate normally. After studying and testing many ways, the Jiangxia Power Station finally solved this problem by electrolyzing the sea water and using paints.

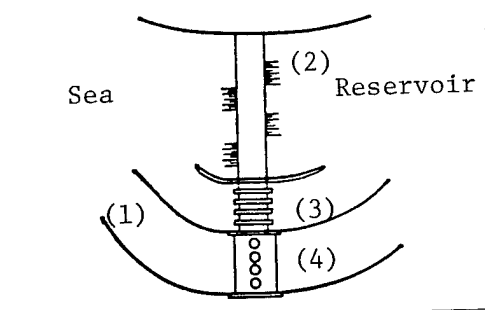


Figure 5.

Key:

(1) Canal
(2) Dam

(3) Sluice gate
(4) Plant housing

While Jiangxia Power Station has realized gains from generating electricity, it also realized many gains from comprehensive utilization, such as aquatic culture, farmland water conservancy, shortening transportation lines, and their total gain was not less than the gain from generating electricity. Therefore, in future research to develop and utilize tidal resources, we should fully develop the gains from comprehensive utilization. When considering the economic properties of a tidal power station, we should fully estimate each gain from comprehensive utilization and its corresponding share of investment. Only in this way can we fully and rationally measure the economic properties of the tidal power station and realize the greatest national economic gain.

In our nation, besides the Jiangxia Tidal Power Station, there are also the Ganzhutan Tidal Power Station in Guangdong, the Shashan Tidal Power Station in Zhejiang, and the Rushankou Tidal Power Station in Shandong. These tidal power stations all have their own characteristics and they operate well.

III. Problems That Need To Be Studied

A. Tidal power stations are characterized by a large amount of flow and a small waterhead. Therefore, they need more and larger water turbine generators. This uses more steel. The power stations are all situated in mouths of tidal rivers or in harbor areas and bays. The construction scale is large and conditions of construction are more complex. These are all reasons for the large investment. But can we aim our efforts at these reasons and think of ways to reduce the investment in capital construction? Analysis of the composition of the entire investment shows that investment in the water turbine constitutes 60 percent of total investment. To reduce the construction cost of water turbines, we can study ways of improvement in two aspects: First, we can change the large amount of flow and small waterhead into a large waterhead and small amount of flow, i.e., using hydraulic transformation to reduce the diameter of the water turbine, the number of units, the amount of steel used and the investment. At present, some units have begun research in this

regard and they have realized preliminary achievements. If we consider a small waterhead, we note that its requirement for structural strength of the water turbine is not high, therefore we can use other materials to replace steel, such as reinforced concrete, wire net cement and glass fiber reinforced plastic. Bulb-shaped flow-through water turbines built of reinforced concrete have already been used in some tidal power stations. Similarly, because of the characteristics of the small waterhead, the requirements for structural strength of engineering structures in the sea, such as the sluice gates and the dams are not high. Some can use light structures such as prefabricated reinforced concrete buoyant sluice gates and rubber dams. In addition, we can also consider using blasting methods to treat the foundations of structures and such advanced construction methods to reduce the amount of construction and investment in engineering structures in the sea by a large scale. The various structural types and construction methods described above all have successful experiences in our nation and abroad. The possibility of realizing large-scale savings in investment by continuing research and popularization on this basis is entirely present.

B. Tidal power stations must cease generating electricity during level tides because the difference in water levels inside and outside the reservoir gradually disappears. This is unfavorable to the users. To solve this problem, we can use double reservoirs for power generation, and we can also join the tidal power station with the large power network so that the power system's hydroelectric power stations, pumping and storage power stations or generators that can be started up in a more versatile manner can compensate and regulate the tidal power station. This means, when the tidal power station stops generating electricity, the hydroelectric power stations and others can generate more electricity to compensate for the deficiency. When the tidal power station generates electricity, hydroelectric power stations and others can generate less electricity, and the electricity can be stored inside the reservoir. These are all feasible ways to solve the problem of intermittent generation of electricity by tidal power stations. In addition, whether there are other better methods still requires further research.

C. The problems of alluviation and silting of mud and sand in the mouths of coastal rivers, harbors and bays commonly exist. After building engineering structures such as tidal power stations in these areas, the pattern of movement of mud and sand in river mouths, harbors and bays will surely change. Therefore, when building tidal power stations, we must study the patterns of change in alluviation and silting of mud and sand under the specific natural conditions of each harbor, each bay and each river mouth, and the actual operating condition of the tidal power station so that we can implement effective construction measures, suppress silting of mud and sand and guarantee normal operation of the power station. The problem of alluviation and silting of mud and sand has different characteristics in each harbor, bay and river mouth, but there are also common patterns. It is necessary to study and explore them. Many localities along the coast have already built sluice gates and many other engineering structures in the sea. Their operation over a long period has accumulated a lot of experience in solving the problems of silting of mud and sand. These have all provided very favorable conditions for solving the problem of silting of mud and sand in the future.

At present, the need for energy resources is very large. It is necessary to develop tidal energy resources in a big way.

Our nation's coastline is long, the reserve of tidal energy resources is rich, and there are many coastal harbors, bays and river mouths. We do not lack favorable topographic conditions to build tidal power stations. Our nation has already built a tidal power station with a modern technical standard. In the future, we have all the conditions to rely on our own technical strength to carry out construction self-reliantly. If we can effectively utilize the new techniques described above through economic analysis, fully develop the gain from comprehensive utilization, tidal energy resources will surely become a fairly effective economic energy resource.

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CS0: 4013/148

SUPPLEMENTAL SOURCES

PROSPECTS FOR DEVELOPING OCEAN ENERGY RESOURCES IN CHINA

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 4, 25 Aug 82 pp 42-43

[Article by Liu Heshou [0491 7729 1343] of the Guangzhou Energy Research Institute of the Chinese Academy of Sciences: "Our Nation's Ocean Energy Resources and Their Development"]

[Text] I. Ocean Energy

The vast oceans contain huge amounts of energy, including thermal energy created by the temperature difference in the upper and lower layers of ocean water, dynamic energy created by tides, tidal currents, waves and such movements of sea water, and chemical energy created by the difference in concentration of salt between fresh water and sea water when fresh water from rivers flows into the ocean.

Ocean energy comes from solar energy and the mutual effects between celestial bodies and the earth. We may say that the ocean is a huge storehouse of energy. The energy it stores is broadly distributed (the oceans occupy 71 percent of the total area of the earth's surface). It is inexhaustible. Compared to hydraulic power and wind power on land, ocean energy is more stable and its variation has a fixed pattern which can be accurately predicted. For example, the energy from temperature differences in sea water within a fixed area of ocean currents changes according to the seasons while the range of variation in tides and tidal currents are cyclic. In addition, ocean energy, when compared to solar energy on land, is present 24 hours a day. These have provided favorable conditions for the development and utilization of ocean energy. Of course, oceanic energy resources are deposited in the ocean environment. The dynamic effects of wind, waves and currents in the ocean sometimes are destructive. Chemical corrosion and the growth of marine life on engineering structures in sea water have brought about many difficulties in construction and design. In addition, density of the energy is low, construction cost is high, and these affect the ability of ocean energy to compete with other types of energy. But as the shortage of energy becomes more severe, it still remains one type of energy which can be utilized at present.

II. Our Nation's Ocean Energy Resources

China's ocean territories are broad. The coastline of the Chinese mainland is over 18,000 kilometers long. There are over 5,000 islands. The coastline

of the islands is about 14,000 kilometers. The East China Sea has an area of 4.88 million square kilometers. South China Sea, in the low latitudes, occupies an area of 3.6 million square kilometers. The amount of fresh water from the rivers flowing into the sea is about 2 to 3 trillion cubic meters/year. The magnitude of ocean energy of all types is higher than that of other nations of the world. Our nation's ocean energy resources are rich. There is a bright future for development and utilization. They will be separately introduced below according to the different types of ocean energy:

1. Tidal Energy. Along our nation's long coastline, there is a rich deposit of tidal energy. According to the two major general surveys conducted in 1958 and 1981, the reserve is 110 million kilowatts, equivalent to an annual output of 275 billion kilowatt hours of electricity. About 38.5 million kilowatts can be developed, or 87 billion kilowatt-hours, equivalent to 47 Xin'an Jiang Hydro-electric Power Stations. China is one of the world's nations with relatively rich tidal energy resources.

2. Ocean Thermal Energy. Most of China's seas are in the lower latitudes. The temperature difference between the ocean surface and the deeper layers is about 20°C. The total area of the sea that can be developed is about 3 million square kilometers. Calculating according to a density of 0.212 kilowatt/square meters of energy flow from sunshine measured on China's Xisha Islands, the total average annual energy from sunshine over that area is 0.6×10^{12} kilowatts. If we calculate the rate of utilization of solar energy and the efficiency of conversion of thermal energy in the ocean at 1 percent and 2 percent respectively, then the amount of thermal energy in the oceans in our nation's territorial seas that can be utilized is about 120 million kilowatts.

3. Wave Energy. The average height of waves in the Yellow Sea and East China Sea is 1 to 1.5 meters and 1.5 meters in the South China Sea. The annual average wave cycle is about 6 seconds. The resources are also rich. According to estimates, the total power of waves transmitted to our nation's shores from the ocean is about 150 million kilowatts.

4. Energy Created by the Difference in Salinity of Sea Water. The amount of fresh water flowing from our nation's rivers into the ocean is about 2 trillion cubic meters a year. The difference in infiltration pressure is about 24 atmospheric pressures. Estimates based on this show that the reserve of such energy is about 150 million kilowatts.

5. Ocean Currents. The ocean currents in the coastal seas of our nation have an estimated energy of 50 to 100 million kilowatts.

6. Tidal Currents. The reserve is also very rich. For example, the energy reserve of tidal currents in the 6 larger navigational channels in the Zhoushan Islands is about 3 to 4 million kilowatts.

III. Views on the Development and Utilization of Ocean Energy

Our nation's oceanic energy resources are rich. The amount that can be converted into useful power is at least 150 million kilowatts. This value is over twofold the total installed capacity of electric power in our nation at present.

Most of it is distributed along the coast of eastern China and Guangdong where sources of energy are lacking, where the population is concentrated and where industry is more developed. Therefore, developing oceanic energy resources in these regions has special meaning.

During the 1950's, our nation built a group of small tidal power stations and obtained large amounts of experimental data. On this basis, we planned and designed the Jiangxia Tidal Power Station in Zhejiang Province. It is second only to the Rance Tidal Power Station of France in the world today. The total installed capacity is 3,000 kilowatts. The first 500-kilowatt generator has already begun operation. We have also conducted some experimental research in wave energy and tidal current energy. But, generally speaking, our nation's research in and development of oceanic energy are only the beginning. The following views on how to develop oceanic energy are presented:

1. Strengthening Leadership. The development of ocean energy involves many sciences, many sectors, and requires a guided and unified plan to concentrate scientific and technical forces to carry out research according to plan and step by step.
2. Carry Out General Survey of Ocean Energy. The development of ocean energy, like the development of other forms of energy, requires a detailed survey of the resources. Therefore, from now on, we should organize a relatively large force to carry out this work. The tidal energy which had been generally surveyed can be further surveyed in detail, and points can be selected to establish a foundation for engineering designs.
3. Strengthen Research in Basic Theory. Because of the special environment in which ocean energy is produced, the energy density is low. To obtain a fairly large magnitude of energy, we must first make breakthroughs in basic theoretical research, and we must carry out simulation experiments and prove the plans. Yet, in this aspect, our strength is weak and it urgently needs to be developed.
4. Start Out From the Practical and Take Small Size as the Key. The development of oceanic energy is still at the beginning stage throughout the world today. The degree of technical development can generally be divided into four types: (1) Tidal energy with mature developmental technology has now entered the stage of technical and economic evaluation and engineering planning. (2) Engineering research in the utilization of thermal energy in the oceans is being carried out. (3) The utilization of wave energy (individual and small projects have already been commercialized) is being experimentally studied using models and real projects. (4) The utilization of ocean currents and the use of differences in salinity are still at the stage of basic study. Research in ocean energy in some nations emphasizes finding an industrial-type energy substitute. Because of the present situation in ocean energy research in our nation and the present strength of our nation, we should start out from the practical, and first develop some small projects to provide electricity for economic buildup and national defense buildup, such as electricity for navigation aids, lighthouses, buoys, oceanographic observation stations, maritime work teams, isolated islands and remote fishing villages. At the same time, we can accumulate experience to prepare well for future large-scale development.

Regions with relatively strong oceanic energy, regions which have a close relationship to industry and agriculture and which also severely lack energy can go one step ahead to carry out some surveys, make plans and develop feasibility studies so that the resources can be developed at an appropriate time.

We believe that our nation's development of ocean energy will become an important link in developing the oceans. In the general trend of transition of the forms of energy and diversification of the energy structure, there will surely be great developments that will benefit mankind.

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SUPPLEMENTAL SOURCES

ZHOUSHAN ISLANDS MAKE SUCCESSFUL USE OF TIDES TO GENERATE POWER

Hangzhou ZHEJIANG RIBAO in Chinese 24 Jul 82 p 1

[Article by Mao Dechuan [3029 1795 0278]: "Experiment To Utilize Tides To Generate Electricity Is Successful in Zhoushan; Ocean Energy Group of the State Scientific and Technological Commission Believes Tides Are Strong Energy Sources To Generate Electricity"]

[Text] The Zhoushan Islands have successfully completed a scientific experiment to generate electricity from tides. This experiment was conducted in Xihoumen Strait outside Hangzhou Bay. The area is the shipping channel between Shanghai and Wenzhou. When the experimental vessel with an installed capacity of 8,000 kilowatts dropped anchor in Sihoumen Strait between Zhoushan Island and Jintang Island, the generator generated electric power as the tides ebbed and flowed. The several dozen electric lamps on board the experimental vessel lit up instantaneously. The electric power generated by the tides cooked the rice on the electric stove and operated the small electric water pump.

This experiment was conducted by the Zhoushan Regional Science Committee and the Dinghai County Science Committee with the help of scientific research agencies and higher educational institutions of the Ministry of Electric Power, the Guangdong Energy Research Institute of the Chinese Academy of Sciences, the East China Power Bureau, and Qinghua University. The experiment went through three experimental stages from indoor simulation and generating electricity on a towed vessel to the generation of electricity by tides at the scene of the anchored vessel. The longest duration of power generation by tides lasted 81 hours. Its voltage was stable, there was no destruction of the ecological balance and environmental pollution.

Recently, the Ocean Energy Group of the State Scientific and Technological Commission and the provincial science committee jointly organized an ocean energy inspection group to go to Xihoumen in Zhoushan to inspect the site. Everyone believed tides are a strong energy source that can generate electricity. Utilizing tides to generate electricity does not require building dams and embankments, it is not afraid of sedimentation of sand and silting, and there is a bright future in developing sources of electricity in the ocean.

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SUPPLEMENTAL SOURCES

YIN FATANG TALKS ON HARNESSING SOLAR, WIND ENERGY IN XIZANG

HK210749 Lhasa Xizang Regional Service in Mandarin 0000 GMT 21 Oct 82

[Text] In his talk to the science and technical personnel of Naqu Prefecture, Yin Fatang, first secretary of the Xizang Regional CPC Committee pointed out: We must strengthen leadership, heighten our confidence and create a new situation in the use of solar energy.

Comrade Yin Fatang said: The building of energy resources is one of the strategic focal points put forward by the 12th CPC Congress. Xizang is rich in energy resources and, in particular, has inexhaustible solar energy resources. It is imperative to grasp this work well.

Recently, the scientific committee of Nazu Prefecture has looked into the work of exploiting and utilizing energy resources. The results of the successful experiment carried out in generating electricity from wind energy in March of this year were quite effective. They have already popularized these experiments in solar cookers and solar water heaters and actively put solar bathrooms into operation. Comrade Yin Fatang was very interested in the work of exploitation and utilization of energy resources in Naqu Prefecture. He made a special trip to the testing ground of the wind energy generator and viewed the generation, distribution and supply systems.

Comrade Yin Fatang said: The strong winds of north Xizang which used to be abhorrent have now become a treasure, cherished by all. Xizang enjoys exceptional advantages in solar energy and also has a long history in utilizing solar energy. Due to lack of attention from the leadership, the work in this field was not grasped well. Comrade Hu Yaobang attaches great importance to the problem of energy resources in Xizang. Whenever he meets me, he mentions this problem. At present, Xizang has placed the problem of energy resources as the key to transformation in 3 years. I hope that you will have confidence and be successful in the utilization of solar energy. This is a concrete measure toward implementing the strategic tasks issued by the 12th CPC Congress. You can recommend yourselves to a great extent if this work is done well, for it not only solves practical needs but also dismisses feudal and superstitious ideas.

CSO: 4013/44

SUPPLEMENTAL SOURCES

BRIEFS

FUJIAN WIND POWER GENERATOR--The installation of a 55-kw experimental wind power generating station, jointly designed by the Fujian Electric Power Experimental Research Institute and the Fujian Machinery Institute, has been completed in Pingtan County. After trial runs, the operation is normal. The tower is 16.5 meters high and the blades have a diameter of 21 meters. (abstracted from FUJIAN KEJIBAO [FUJIAN SCIENCE AND TECHNOLOGY]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

WIND POWER GENERATOR BUILT IN HEILONGJIANG--The Heilongjiang Machinery Research Institute has successfully trial manufactured a Model FD-17 20-kw wind power generator. This wind power generating unit uses an automatic speed control system. It is suitable for high, cold regions and provides a new power supply for production and daily living of people in the far border rural areas and grazing regions. (abstracted from XINWEN ZHAOPIAN [NEWS PHOTOGRAPHY] of XINHUA News Agency) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

WIND POWER USED ON WEIZHOU ISLAND--Weizhou Island, Guangxi, is located in Beibu Wan. The average wind speed during the year is 5.1 meters/second and can be utilized during all four seasons of the year. In order to utilize this wind power to generate electricity, a wind 2-kw power generator was purchased from Nei Monggol. Based on the actual conditions of the island, the electrical parts of the generator were remodeled and the height of the wind tower was extended from the original 12 meters to 15 meters. It has started generating electricity. Its power supply is meeting the design requirements and adequate power is being supplied to the sea cucumber farm on the island. After seeing this result, the masses on the island are asking for the installation of wind power generators one after another. Through the efforts of the engineering technical personnel of Beihai Municipality Agricultural Machinery Research Institute, a small wind power generator of 300 watts costing only a few hundred yuan has been trial manufactured. It can be used in areas where the average wind speed is over 2 meters/second. Currently, this generator is being modified. Once the final model is decided upon, it will be produced in large numbers. (abstracted from GUANGXI KEJIBAO [GUANGXI SCIENCE AND TECHNOLOGY]) [Text] [Shanghai DIANSHIJIE [ELECTRICAL WORLD] in Chinese No 9, Sep 82 p 31] 5974

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